THE EFFECTS OF EXERCISE ON SELECTED CLASSROOM BEHAVIORS OF EMOTIONALLY HANDICAPPED ADOLESCENTS

BY

WILLIAM H. EVANS

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William H. Evans

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This study was conducted in order to determine the effect of physical activity on the classroom behavior of emotionally handicapped adolescents. A review of the literature suggested a long held belief that vigorous exercise is related to improved behavior and emotional states.

Six emotionally handicapped sixth, seventh, and eighth graders participated in jogging and outdoor reading sessions. Three of these subjects also engaged in winning and losing football contests. A single case extension of a basic ABA design was followed. Replication of the effects of physical activity occurred within and across all subjects.

Daily data were collected in the class period following the experimental treatment. Dependent measures included the number of talk outs occurring per class session, teacher ratings, dean's reports, and the number of completed written assignments.

An examination of the data indicates that a decrease in talk outs and an increase in teacher ratings as well as completed written tasks was associated with the football and jogging treatments. A comparison of talk outs and completed tasks indicated that the scores obtained during jogging and football treatments exceeded the 15 percent difference to baseline scores criterion established to reflect significant differences. In addition, no significant differences were noted during the outdoor reading phase.

The results of this investigation suggest that physical activity may be a valuable therapeutic technique to use with emotionally handicapped youth. Future research may explore the relationship of various forms of exercise and body physiology function during exercise to changes in behavior.

CHAPTER I

INTRODUCTION

A relationship between physical exercise and mental functioning was postulated by the ancient Greeks. Aristotle believed education was a mixing of teaching mental and physical tasks;

> Care for the body must precede care for the soul; next to care for the body must come care for the appetites; and last of all care for the intelligence. We train the appetites for the sake of the intelligence and the body for the sake of the soul. (Davidson, 1912, p. 172)

Greek writers and teachers such as Plato, Socrates, Lucian, and Pythagoras believed that mistakes in thinking and intellectual laziness were due to poor physical conditioning. This belief was clearly stated by Xenophon, a student of Socrates.

> Weakness of memory, low spirits, ill-temper, and even insanity often penetrate the minds of many persons so deeply through their bad physical condition, as to cast out and disposses knowledge. There is great security, on the other hand, for those bodies in good condition, they run no risk of suffering any such evils. (Payne, 1892, p. 276)

Vigorous exercise provided the backdrop for intellectual and moral training in Greek schools. There was a strong belief that physical development resulted in the creation of personality characteristics such as poise, self-confidence, and courage (Eby & Arrowood, 1940). Many social institutions developed by the Greeks have contributed to the foundation of Western society. The belief in a relationship between physical development and emotional functioning is but one aspect of Greek society that has been incorporated into current thought and practice.

The presumption of a relationship between physical activity and emotional functioning served as the basis of many social practices during the Renaissance. Humanistic philosophers of the fifteenth, sixteenth, and seventeenth centuries believed that the body needed physical activity in order to improve the moral self (Hackensmith, 1966). The extent of this thought is put forth by the fifteenth century educator Petrus Vergerius:

> But where an active frame conjoined to a vigorous intellect, true education will aim at the efficient training of both—the Reason that it may wisely control, the body that it may properly obey. (Woodward, 1906, p. 106)

Schools of the Renaissance gave a major role in their curriculum to physical development. Schools were established that emphasized the development of the physical and intellectual domains. The importance of this melding was referred to by the fifteenth century author Aeneus Sylvius Piccolomini (later to become Pope Pius II) when he stated, "both mind and body, the two elements of which we are constituted, must be developed side by side" (Woodward, 1905, p. 124). The sixteenth century French essayist Montaigne stated that if schools and parents stressed physical exercise, improvement would be noted in manners and behavior. The necessity of physical training can be seen when he states, "It is not enough to fortify the soul; you must also make the muscles strong. The mind will be oppressed if not assisted by the body" (Montaigne, 1910, p. 67).

Philosophers such as John Locke pointed out that vigorous exercise was an effective tool that could be used in schools to improve behavior and attention to work. The extent of the relationship that Locke noticed is seen in the manner in which he describes the relationship between physical fitness and mental states.

> A sound mind in a sound body is a short but full description of a happy state in this world; he that has these two has little more to wish for, and he that wants for either of them, will be but little the better for anything else. He whose mind directs not wisely will never take the right way; and he whose body is crazy and feeble will never be able to advance in it. (Gay, 1964, p. 19)

This notion was furthered by Rousseau in the eighteenth century when he stated that physical and intellectual training were closely related. He concluded, as did Immanuel Kant, that a vigorous mind was dependent on a vigorous body (Fenton, 1943). Thomas Jefferson, in his educational writings, made reference to incorporating physical activity into the school curriculum. "The sympathy between the mind and body during their rise, progress, and decline, is too strict and obvious to endanger our being misled" (Randolph, 1829, p. 83). As a result, physical activity became a part of the school curriculum and served as a means of improving behavior and mental functioning (Cubberley, 1948).

The advent of public education in the United States witnessed the establishment of physical fitness programs which were thought to increase alertness and improve behavior and work habits (Dulles, 1965). Vigorous exercise such as running, leaping, wrestling, and swimming were recognized by Benjamin Franklin as the type of exercises that served to increase attention and improve work habits in school. This relationship was noted by Noah Webster who believed exercise was an effective means of improving work and behavior in school. Vigorous physical activity, stated Webster, was as necessary as spelling instruction.

> It should be the business of young persons to assist nature and strengthen the growing frame by athletic exercises. When it is not the lot of a young person to labor in agriculture or mechanic arts, some laborious amusement should daily be pursued as a substitute and none is preferable to fencing. A fencing school is, perhaps, as necessary an institution as professorship in mathematics. (Leonard, 1922, p. 16)

The use of exercise as a means of improving behavior was further institutionalized in the 1850's with the birth of organizations such as the Young Mens Christian Association (YMCA), Campfire Girls, and the Young Womens Christian Association (YWCA), whose primary concern was to provide a positive alternative to delinquency. Exercise served as a "safeguard against the allurement of objectionable places of resort" (Sherwood, 1944, p. 93). These organizations stressed that a blending of the physical, moral, and intellectual selves could occur only through vigorous exercise.

This socially popular view of physical activity spawned the creation of the Delsarte system of education. Many schools and social programs built curricula based on the Delsarte system in order to train children to develop socially acceptable beliefs. By 1892, 12 percent of American schools were using the Delsarte system of education (Kindervater, 1926).

Francois Delsarte, a French vocal and dramatics teacher, developed a system of education that combined physical movement with the teaching of academic subject matter. The basis of the Delsarte system was the use of motion to express states of mind and increase concentration. Delsarte stated,

> Now to know what he ought to seek, the student needs an exactly formulated definition of art, of its object, of its aim, of its means. This definition, to be practical, should carry the irrefragible character of a demonstration. (Stebbins, 1902, p. 58)

Vigorous precise exercise served as the essential ingredient in this system. Every mental activity had a physical counterpart as can be seen in the following directions.

> The action of the head and arms in the above movements must be made simultaneously. Each action flows into the subsequent one. Always retain a gesture as long as the same thought or emotion is retained, or one remains in the same mood. (Stebbins, 1892, p. 202)

Exercise involved the head, all appendages, eyes, voice, mouth, and face.

The goal of exercise and intellectual pursuits was to bring into harmony the three parts of the Trinity in Expression: Love, Wisdom, and Power (LaFavre, 1891). The Delsarte system stressed that an individual's full potential could be achieved through a melding of the three parts of the Trinity. Education, therefore, sought to unite the moral, intellectual, and physical selves. As Delsarte stated,

> This manner of looking at man shows us the role of two natures in their manifestations. To each spiritual function responds a function of the body. To each grand function of the body corresponds a spiritual act. Thus we can at the same time study separately that which is of the spirit and that which is of the body; thus from the concurrence of these two powers in the same person, results the ultimate fusion of art and science, which, though each one is born of a different source, nevertheless ally, interpenetrate, and reciprocally prove each other. (Stebbins, 1902, p. 67)

Equally as widespread in America in the late 1800's and early 1900's was the German school of physical education. Friedrick Jahn, the founder of the German system, believed that through group participation in physical games, students would develop morally and intellectually. "Play is a school for righteous thinking and acting; a school for self-control, good fellowship, and self-government" (Hackensmith, 1966, p. 235).

Formal physical education programs expanded in relation to the claims of their proponents. In 1892, states began enacting laws requiring physical education in the public schools. By 1925, 33 states had made physical education in the schools mandatory (Weston, 1962). With legislation came definitions and goals for physical education programs. Typical of these was the following statement:

> The general aim of physical education is social efficiency, which includes such specific aims as organic health and vigor, normal physical development, freedom from physical defects, efficient motor control, grace agility, endurance, and general physical fitness; alertness, courage, judgment, initiative, imagination, obedience, honesty, unselfishness, cooperation, and loyalty. (Rice & Hutchinson, 1952, p. 240)

Mental health was viewed as a mosaic of the physical and emotional domains. Programs were predicated on the belief that by gaining control over the body, mental and behavioral conditions could be altered so that rational thought and education could take place (Nash, 1931). An example of the thinking underlying this position is put forth by Radler and Kephart (1960); "motor activity underlies all behavior including higher thought processes" (p. 85). Statements which were once philosophical in nature were now becoming an established and accepted part of American education.

> The experience of the athletic field produces effects too subtle to measure. Yet we cannot doubt their existence. Here in the classroom and gymnasium are in constant operation moral and cultural forces just as indispensable to civilization as knowledge or any material elements. (Educational Policies Commission, 1946, p. 64)

Presidents Roosevelt, Truman, Eisenhower, and Kennedy each appointed commissions which established fitness programs in American schools. A major premise of these programs was that if students were physically fit, they would also be emotionally stable and more apt to learn in the classroom (Weston, 1962). President Kennedy referred to this when he said, "Since the time of the ancient Greeks, we have felt that there was a close relationship between a strong vital mind and physical fitness" (Bucher, 1968, p. 183).

Physical education has assumed a role in education which reflects the historical accumulation of beliefs concerning the relationship between vigorous physical activity and mental health. Adams (1960) identified 31 sets of goals that listed improved personal-social adjustment as a major function of physical education. The extent of this relationship is witnessed in the following statement concerning the effect of physical activity.

> A vigorous physical education program has the potential, it is believed, to contribute to proper group adjustment, to the development of such desirable social traits as honesty, sportsmanship, and reliability and to the development of a socially desirable person. (Scott, 1960, p. 307)

A close relationship between personality traits considered positive, such as honesty, reliability, and physical activity was referred to by Wilkerson and Dodler (1979). This notion has been supported by a number of reports. Biddulph (1954) and Seymour (1956) propose that individuals that participate in physical activity are better adjusted psychologically. In an early work, Davis (1929) stated that exercise was of great benefit to psychiatric patients. Cratty (1965) and Wallin (1935) supported Davis in suggesting that exercise can be an effective means of reducing intrapersonal tension and overcoming emotional disorders. The relationship between exercise and improved physical and emotional health was explored by Bortz (1960) and Arnett (1968) with the conclusion that there was a direct relationship between improved physical fitness and increased self-regard. Aggression and interpersonal relationships were explored by Paxon (1970) who offered the idea that physical activity is a socially acceptable means to release aggression. Beisser (1970) and Nixon and Cozens (1947) furthered this notion and suggested that exercise acts as a substitute for overt physical aggression.

The professional literature suggests a relationship between physical activity and psychological adjustment. Given this contention and the unparalleled interest and increase in the number of Americans who have taken up physical fitness, authors such as Kostrubala (1976) and Glasser (1976) state that physical activity such as jogging is beneficial in improving psychological health.

Glasser, in his 1976 book, recognizes that jogging is currently one of the more popular forms of physical exercise. Jogging is viewed by Glasser as an effective means of dealing with stress and depression which he believes are two of the most pressing problems associated with contemporary American society. The deleterious effects of stress and depression can be seen across social class, sex, and age groups. It is because of this that Glasser strongly advocates the use of jogging as a means by which emotional problems can be avoided. A number of authors have pointed to the relationship between jogging and an improved emotional state in children (Dozier, Lewis, Kersey, & Charping, 1978; Morrow, 1978; Solomon & Bumpus, 1978). These findings suggest that jogging may be an important tool to use with children who are experiencing intrapersonal and interpersonal problems.

Collingwood and Willett (1971) concluded that the individual is an integration of the physical, intellectual, and interpersonal domains. Any change in one domain causes unspecified changes in other aspects of one's life (Eisenburg, 1957). If the physical domain is positively affected, resulting change may occur in other related areas. By affecting the physical domain by jogging, changes may occur in the interpersonal and intellectual domains as well.

Physical education is required of students. Jogging and physical exercise, therefore, represent a tool that could be easily integrated into the educational programs of students. If jogging does improve behavior, it could become a significant factor in developing interventions for emotionally disturbed students. Jogging requires little equipment, and can be done anywhere. It, therefore, represents a potential tool that can be used in a number of settings.

Summary

A review of the historical literature suggests a relationship between physical activity and improved behavior or emotional conditions. Authors for more than 2,000 years have referred to the intellectual and moral effects of physical fitness. The basis for assuming a relationship between vigorous exercise and emotional functioning has been largely philosophical. This relationship that grew out of a quasi-religious practice for the ancient Greeks, has been observed and noted over the centuries. Statements have accumulated and have been used for the basis of other assertions concerning the behavioral effects of physical fitness. Numerous social and educational practices since 350 B.C. have been predicated on a relationship between a sound mind and sound body. As a result, this association has become woven into the beliefs and practices of Western society. It has become an integral part of us and assumes an important role in our lives.

Unfortunately what has come to be accepted as common knowledge has had little scientific investigation. As will be seen in the literature review contained in Chapter II, there is little empirical evidence to support the contention that there is a relationship between exercise and behavioral functioning. This has not prevented, however, the establishment of mental health and educational programs based on the use of physical activity. This lack of evidence forces a critical examination of many programs. An empirical investigation will allow for a more precise analysis of the issues and problems associated with using physical activity as a therapeutic technique.

The Problem

Many positive psychological effects have been attributed to exercise. Few of these have been systematically evaluated. Therefore, the problem under investigation in this study was: Does a relationship exist between an exercise program and classroom behavior? This problem, however, is so broad and varied that all possible aspects could not be examined in one investigation. In order to conduct an investigation, the researcher selected a representative form of exercise that would allow for easy experimental replication.

Purpose

In seeking a representative form of exercise, the investigator was concerned with (a) a clearly defined form of exercise that most students could engage in, (b) no expensive equipment was needed, and (c) a form of exercise in common use. One form of exercise that satisfied these requirments was jogging.

Jogging is currently being used by teachers and therapists in conjunction with other forms of therapy (Damon, 1959; Glasser, 1976; Harper, 1978). Unfortunately the efficacy of jogging as a tool for managing behavior has not been established. The empirical evidence is not sufficient to justify the widespread use of jogging as a therapeutic technique. Data may show that jogging is an effective technique; however, that conclusion cannot yet be stated. The purpose of this investigation was to determine the behavioral effects of jogging, as a formal exercise program, by investigating the relationship between jogging and change in classroom behavior.

Variables

The dependent variables in this investigation were the number and rate of talk outs exhibited by the student in a classroom, the number of written assignments completed per class period, the number of dean's reports, and daily teacher ratings. The independent variable was 15 minutes of jogging prior to class.

Related Questions

This study was designed to investigate two specific questions:

1. Is there a relationship between a jogging program and a change in the number and rate of talk outs?

2. Is there a relationship between a jogging program and a change in the number of completed written assignments?

Assumptions

The following assumptions were made in this study:

1. The students in this study were emotionally handicapped.

2. Jogging may be an effective means of improving emotional functioning.

3. Jogging may be an effective means of improving classroom behavior.

4. Sustained forward movement is exercise.

Delimitations

The experimental population of subjects was selected from Lincoln Middle School, Gainesville, Florida. This school is in Alachua County, is located in north central Florida, and has approximately 950 students in grades six through eight. Subjects for this investigation were selected from those students that were placed in a program for the emotionally handicapped.

Limitations

The limitations of the study were:

1. Measurement of the number of talk outs occurred only the class period following the jogging session.

2. Much of the literature is not empirically based. As a result, few experimental guidelines have been established.

3. The amount of control over the student's school environment was limited because the study was conducted in a public school. This limitation may cause other variables to affect the behaviors of interest.

4. The amount of control over events outside the school setting was limited. These events may affect student behavior.

5. Only one inappropriate behavior for each student was selected.

Definitions of Terms

Formal Jogging Session — That teacher supervised time during which daily records of time and distance run were kept. This period of time commenced with the announcement by the teacher that the session would begin and ended with the student entering the next regularly scheduled class.

Labeled Emotionally Handicapped Adolescent — A sixth through eighth grader who qualified as an emotionally handicapped youth as defined by the Bureau of Education of Exceptional Students (BEES), Rule SBER 6A-6.3016 (Florida Department of Education, 1980) and had been placed in a program for emotionally handicapped youth by the Alachua County Public Schools, Gainesville, Florida.

Jogging —Fifteen minutes of sustained forward movement.

Regularly Scheduled Class — The class in which the student was assigned immediately following the jogging session.

Level of Significance — Discussions with the classroom teacher resulting in the following criteria: A set of scores was significant if the mean score indicated a 15 percent increase or decrease over the mean behavior from the initial baseline period.

Completed Assignments —The number of teacher assigned written tasks completed per class period by the student.

Steady State —A steady state was said to exist when five consecutive data points in an experimental condition yielded a Kappa value not exceeding 1.6 (Johnston & Pennypacker, 1980).

Talk Outs — Any verbalization made in class without teacher permission.

Summary

Jogging represents a potentially useful tool to use with students experiencing behavioral difficulties. There has been, however, little controlled experimentation concerning the relationship of jogging to classroom behavior and task completion. A controlled investigation of the behavioral effects of jogging would begin to establish whether a relationship exists.

CHAPTER II

REVIEW OF THE LITERATURE

In this chapter the results of a review of the literature concerning the effects of jogging and physical activity on behavior and emotional functioning will be presented. The chapter is divided into four sections in which the procedures used for obtaining and selecting relevant literature are detailed, an analysis of the literature is provided, and conclusions are presented.

Selection of the Relevant Literature

Included in this review is the relevant literature that met pre-established criteria and was located using the following sources: ERIC computer search, the Social Science Citations, the Psychological Abstracts, the Index Medicus, the Dissertation Abstracts International, the Education Index, the Physical Fitness and Sports Medicine Index, and the Physical Education Index. Descriptors used in the search included: exercise, running, jogging, physical fitness, developmental physical education, emotionally handicapped, and emotional disturbance.

Once the identified reports were retrieved, the reference and bibliography of each was examined for additional references. Initially the search consisted of locating those studies published from 1969 to 1980. In 1969 Dodson and Mullens published the first data based article concerning the behavioral effects of jogging. From the bibliographies of the articles that were published during the identified years, a number of related articles dating as early as 1929 were also identified. The bibliographies also provided valuable information about which journals most frequently published articles of relevance. Among the journals identified were Research Quarterly, Journal of Clinical Psychology, Perceptual and Motor Skills, and the American Corrective Therapy Journal. The indexes of each of these journals from 1965 to 1980 were also examined.

A survey of the card catalog at the University of Florida's main library revealed several books pertinent to the behavioral effects of exercise. Among the books reviewed was Perceptual-Motor Behavior and Educational Processes by Cratty (1969). This work provides an excellent overview of physical education techniques that can be used with the handicapped. Other books that provided information include The Joy of Running (Kostrubala, 1976), Positive Addiction (Glasser, 1976), and a 1952 work by Eby entitled The Development of Modern Education.

Criteria for selecting reports to be included for critical review were established. First, the report had to contain the following: a single subject or group design, independent and dependent variables, and a specified research strategy. Second, exercise or jogging had to be the therapeutic tool used. Third, a measurement tool had to be used to assess the psychological or behavioral effects. Finally, information on the effectiveness of the treatment had to be provided.

Fifty-eight reports failed to meet the stated criteria for inclusion. Books by Cratty (1969), Glasser (1976), and Kostrubala (1976) were rejected because no data based research strategies were used. Reports by Davis (1929), Bortz (1960), Cooper (1969), Arnett (1968), Beisser (1970), Paxon (1970), Solomon and Bumpus (1978), Rudd and Margolin (1969), and Wilkerson and Dodler (1979) were eliminated in that no supportive data were shown. Works by Morrow (1978), and Seymour (1956) were not included because they failed to measure behavioral or psychological effects.

The Nature of the Literature

The results of the comprehensive review of the literature are presented in Table 1. Fourteen articles were found that met the selection criteria. As indicated in Table 1, the 1969 study by Dodson and Mullens marked the beginning of data based studies describing the relationship between jogging and emotional variables. Three more studies were done from 1970-1974 with 10 more in the period from 1975-1980.

The therapeutic use of jogging has transcended age levels. As is illustrated in Table 1, Buccola and Stone (1975) reported the use of jogging with older aged people while four studies have shown jogging to be effective with school aged individuals (Allen, 1980; Collingwood & Willett, 1971; Dozier, Lewis, Kersey, & Charping, 1978; Klein & Deffenbacher, 1977) and three with college students (Harper, 1978; Leonardson & Gargiulo, 1978; Sharp & Reilley, 1975).

Table 1

Review of the Literature

Author	Type of Study	Problem	Population	Independent Variable	Dependent Variable	Statistics	Results
Dodson & Mullens (1969)	Single Subject	Motivation increased through running	18 psychiatric patients	Jogging 1 mile	MMPI Draw-A-Person POI	None	Jogging related to reduced tension, increased awareness of reality
Collingwood & Willett (1971)	Group no control	Effect of physical training on self-attitude	5 13 to 16 yr. old obese students	1 hr. running 1 hr. swimming	Osgood Test Bill's Index	t-test	Increase in positive self-regard
Collingwood (1972)	Group with control	Effect of physical training on self-concept	25 18 to 26 yr. olds	1 hr. jogging	Body Attitude Scale Behavior Rating	ANOVA	Improvement in interpersonal, intellectual, physical ratings
Powell (1974)	Group with control	Effects of walking & jogging on personality	40 geriatric mental patients	Walking	Weschler Memory Staff ratings	ANOVA	Improvement on memory scale, but not on behavior

Table 1 — Continued

Author	Type of Study	Problem	Population	Independent Variable	Dependent Variable	Statistics	Results
Buccola & Stone (1975)	Group no control	Effects of cycling & jogging on personality	30 60 to 79 yr. old men	Cycling Jogging 25 min.	Cattell	t-test	Joggers showed improvement in somber group dependent factors
Sharp & Reilley (1975)	Group no control	Relationship between fitness & personality traits	65 college students	Jogging	MMPI	t-test	Joggers had higher scores than did non-joggers
Young & Ismail (1976)	Group no control	Relationship between fitness and personality	50 middle aged professors	Jogging 25 min.	Eyesenck Inventory	$\bar{x}$ sd t-test	Increase in extroversion and stability
Kavanaugh & Shephard (1977)	Group no control	Relationship between jogging & depression	44 depressed coronary patients	Jogging	MMPI	$\bar{x}$ sd	Improvement in hysteria, hypochondriosis, psychasthenia
Klein & Deffenbacher (1977)	Group with control	Does exercise improve performance	24 hyperactive 3rd graders	Sports games push-ups	Matching Figure Test (errors)	ANOVA	Exercise group did better on matching test than controls

Table 1 — Continued

Author	Type of Study	Problem	Population	Independent Variable	Dependent Variable	Statistics	Results
Dozier, Lewis, Kersey, & Charping (1978)	Group no control	Will sport groups improve performance	16 12 to 16 yr. olds	Sports Groups	Reports of inappropriate behavior	None	Many made significant gains
Harper (1978)	Group no control	Effect of jogging on college students	10 college students	Jogging	Anxiety Inventory Self-Concept Scale	Wilcoxson matched pairs test	Improvement in anxiety and self-concept
Leonardson & Gargiulo (1978)	Group no control	Relationship between fitness and personality	15 college freshmen	Jogging 30 min.	Personality Rating Scale	Multiple regression	No effects noted
Blue (1979)	Case Study	Effect of jogging on depression	2 psychiatric patients	Jogging	Zung Depression Scale	None	15-18 point improvement on scale
Allen (1980)	Single Subject	Can jogging reduce inappropriate behavior	12 L.D. elementary students	Jogging 15 min.	No. of inappropriate behaviors	$\bar{x}$	Jogging significantly reduced inappropriate behavior

Data show that joggers improved in emotional and behavioral states as measured by projective instruments and rating scales. A weakness in these investigations concerned the measurement instruments used. Additional measures such as direct behavioral observations would have strengthened the results.

While most researchers used rating scales or projective instruments to assess the effects of jogging, only one of the studies listed in Table 1 used direct behavioral observation (Allen, 1980). There was, however, no evidence of agreement checks by a second observer. The researcher chose to group inappropriate behaviors and assess the effects of jogging. This study could have been strengthened had individual behaviors been analyzed.

Failure to control for alternative explanations is a common methodological weakness in much of the jogging literature. All of the studies presented in Table 1 reported an improvement in the dependent measures. These improvements may be due to factors other than jogging in that ten of the studies failed to use either a control group or a baseline period. By adding a control group or baseline period, further support can be given to the therapeutic use of jogging.

Table 2 represents a further refinement of the literature presented in Table 1. To be included in this group, two additional criteria had to be met. By adding these two criteria, a closer critical examination of the therapeutic use of younger subjects can take place. First, some of the subjects involved had to be less than 30 years of age. Narrowing the age range allows an examination

Table 2

Acceptable Literature

Author	Type of Study	Problem	Population	Independent Variable	Dependent Variable	Statistics	Results
Allen (1980)	Single Subject	Can jogging reduce inappropriate behavior	12 L.D. elementary students	Jogging 15 min.	No. of inappropriate behaviors	$\overline{x}$	Jogging significantly reduced inappropriate behavior
Collingwood (1972)	Group with control	Effect of physical training on self-concept	25 18 to 26 yr. olds	Jogging 1 hr.	Body attitude scale Behavior Rating	ANOVA	Improvement in interpersonal, intellectual, physical ratings
Dodson & Mullens (1969)	Single Subject	Motivation increased through running	18 psychiatric patients	Jogging 1 mile	MMPI Draw-A-Person POI	None	Jogging related to reduced tension, increased awareness of reality
Klein & Deffenbacher (1977)	Group with control	Does exercise improve performance	24 hyperactive 3rd graders	Sports games Push-ups	Matching Figure Test (errors)	ANOVA	Exercise group did better on matching test than controls

of the effects of jogging with an age group similar to the one used in this investigation. Second, the design of the study had to attempt to control for alternative explanations for the treatment effect by using either a baseline period or a control group. A more accurate assessment of the effect of the independent variable may be made when alternative explanations are eliminated. The literature presented in Table 2 provides a foundation upon which experimental questions can be formulated. Focusing on an age group similar to the one used in this investigation and attempting to control for alternative explanations allows for a careful analysis of the effects of jogging.

Individual Cases

Dodson and Mullens (1969) reported the use of jogging with 18 psychiatric inpatients who had a variety of psychological disorders. The purpose of the research was to determine whether patient behavior and self-esteem could be improved through a jogging program. Self-esteem was measured by the scores obtained during each experimental phase from the MMPI, Semantic Differential, Personality-Orientation Inventory, and Draw-A-Person Test. The three week baseline condition in which patients engaged in normal activity was followed by three weeks of light exercise. It was not reported what specific light exercises were used. The researchers stated, however, that these activities did not appreciably affect the pulse rate. No differences were reported in the scores measuring self-esteem when comparing the light exercise and baseline periods. The researchers reported improved scores during the three week jogging condition. They concluded that these higher scores indicated the subjects were more accepting of stress, less tense, and more reality based. Examination of the data revealed, however, that statistically significant scores at the .05 level were obtained on only two of the four portions of the MMPI, none of the three parts of the Personality Orientation Inventory, one of the four parts of the Draw-A-Person test, and one of the three portions of the Semantic Differential Test. The data also revealed that differing numbers of subjects were tested with each instrument across experimental conditions. Only four of 18 subjects were tested on each portion of the instruments during the baseline condition, 13 of 18 during the light exercise, and 10 of 18 in the jogging phase. It was not reported whether the same subjects were tested across conditions, but it appeared that a number of subjects were not tested on all instruments during each of the experimental phases.

The differences in reported scores must be viewed cautiously in light of the irregularities in the data. It must also be noted that no direct behavioral observations were used to verify the claims of changes in the behavior of the subjects.

Collingwood (1972) investigated the effect of physical activity on self-concept and interpersonal behaviors by matching 25 pairs of subjects from a rehabilitation facility on the basis of staff evaluations of behavior and emotional difficulties. The experimental group engaged in one hour of strength exercises, jogging, and agility drills daily for four weeks. Pre and post measures on the Body Attitude

Scale, Bills Index of Adjustment and Values, and staff ratings were used to measure self-esteem and improvement in behavior.

An analysis of the data indicated that both the control and experimental groups registered statistically significant scores at the .05 level on the Body Attitude Scale. An examination of the data also demonstrated that the experimental group recorded statistically significant scores on two of the four sections of the Bills Index of Adjustment and Values.

The behavior ratings suggest that the vocational staff believed 50 percent of the experimental subjects achieved a positive behavioral change while 30 percent of the control group achieved a positive change. These ratings demonstrated a less than complete effect in that 50 percent of the experimental population was not positively affected. The extent of the behavior change attributed to the affected 50 percent is not mentioned. It is not clear if the noted behavior change is substantial or trivial in nature.

The authors' conclusion that physical exercise improved behavior may be somewhat precarious in that the vocational staff was aware of which subjects were in the experimental group. These ratings were not verified by independent observers. It is, therefore, difficult to determine if the data indicated a real change in behavior of the experimental subjects or a reaction of the raters to prior knowledge of group assignment.

The 1977 study by Klein and Deffenbacher investigated the effect of exercise and relaxation training on cognitive performance. Through teacher ratings, 24 hyperactive third graders were identified. The subjects were then assigned to one of four groups: muscle relaxation, large muscle exercise, attention-placebo control, or no treatment control. Individuals assigned to the muscle relaxation group practiced progressive muscle relaxation. The large muscle exercise group participated in agility, power, and speed tasks while the attention group made objects with modeling clay. Cognitive performance was measured by administering the Familiar Figures Test and a shortened version of the Continuous Performance Task one week after the end of the formal training session.

Data from the matching figures test showed that the mean error rate of 7.33 for both the exercise and relaxation groups was lower than the 10.17 rate of the attention-placebo control group and 15.0 for the no treatment control group. The exercise group recorded an 11.33 error rate on the performance test versus 8.83 for the relaxation group, 9.50 for the attention-placebo control group, and 14.0 for the no treatment control group.

The authors reported a statistically significant difference in the scores obtained by both the relaxation and exercise groups on the matching figures test, but not on the performance test. They indicated, however, that had the complete Continuous Performance Task been used, statistically significant scores would have been noted. The authors stated that the data suggest a relationship between exercise and improved scores on academically oriented tasks. The results partially support this contention. The researchers did not investigate the effect of exercise on classroom performance. Adding a measure of the effect of exercise on classroom work would have greatly aided the analysis of the effectiveness of the treatment.

Allen's (1980) study represented the first reported use of direct observation in measuring the behavioral effects of jogging. Students in a class for the learning handicapped jogged for five or ten minutes before school twice a week. Measurement consisted of observing the frequency of occurence of five categories of behavior in the following class period. The categories were hitting and bothering others, name calling and throwing things, yelling and talking out of turn, moving or sitting inappropriately, and refusing to cooperate or participate. The individual data were then grouped and compared to non-jogging days.

The data show that the researcher combined the five categories of behavior and labeled it "classroom disruptions." The results indicated that the daily mean classroom disruptions decreased from 63.0 during baseline to 37.3 when five minutes of jogging occurred and 31.8 when ten minutes of jogging was in effect. The researcher concluded that there is a relationship between jogging and classroom behavior. While a relationship is suggested, there are several factors which adversely affect the study.

Jogging was the only experimental condition used in Allen's (1980) study. As a result, it is not possible to determine whether the effect occurred because of jogging or engaging in some non-classroom activity. The grouping of the categories and individual data does not allow an analysis of the possible interactions between specific behaviors and jogging. While classroom disruptions as a whole decreased during jogging, specific behaviors may have been differentially affected. It is not possible to tell from the data the effect that jogging had on the individual behavior of the subjects. The presentation of these data would have allowed an analysis of the specific effect of jogging on each subject.

A further flaw in the Allen study appeared in the failure to use more than one observer. Logistical concerns may account for this, but using one observer seriously threatens any conclusions drawn from the study. Allen noted in the study that students appeared better able to attend to their tasks during the jogging condition. She failed, however, to present any evidence indicating increased time on task or work completed to substantiate this claim.

Summary

Research suggests a relationship between jogging and improved behavior. Improvement in scores on rating scales and projective instruments have been noted across age categories and emotional difficulties. Much of the literature, however, fails to control for alternative explanations with the use of baseline data or control groups. Any conclusions that can be drawn from the literature, therefore, must be viewed with caution.

The four reviewed studies presented in Table 2 that did attempt to control for alternative explanations presented data that suggest a relationship between jogging and improvement in behavioral measures. These investigations have provided the groundwork for a thorough and systematic analysis of the effects of jogging on task completion and inappropriate behavior.

An analysis of all the reviewed literature suggests a number of conclusions.

1. Jogging has been used as a therapeutic technique with many different age groups.

2. Jogging was not compared to other forms of vigorous exercise. As a result, it cannot be determined if other forms of strenuous exercise could produce comparable effects.

3. Few of the studies reviewed eliminated alternative explanations for the changes noted in the dependent measures. Including a baseline phase, control group, or other non-classroom activities would have begun to eliminate other explanations for changes in behavior.

4. Improved scores on instruments that measured emotional functioning, anxiety, and self-concept suggest a relationship to jogging. There were, however, few attempts to verify these results with behavioral observations.

5. Many of the studies suggested that jogging was related to increased work output. None of the studies, however, reported any direct measure of task completion to verify these claims.

CHAPTER III

METHODS AND PROCEDURES

The relationship between vigorous exercise and behavior has been noted for over 2,000 years. Many aspects of Western society are founded on the belief that a relationship exists between strenuous activity and behavior.

A currently popular form of physical activity is jogging. Professional literature suggests the utility of jogging to treat a broad array of problems across numerous age categories. Improvement in emotional functioning and self-concept as well as the lessening of stress and anxiety have been mentioned as being related to jogging.

There has been, however, little attempt to systematically study the use of jogging in treating behavior disorders and its effect on classroom behavior. Jogging may very well be a useful tool for the therapist and teacher alike. Therefore, a thorough study of the relationships involved appeared to be quite appropriate. The issues of primary concern were:

1. Is there a relationship between a jogging program and a change in the number and rate of talk outs?
2. Is there a relationship between a jogging program and a change in the number of completed written assignments?

Subjects

Six middle school students labeled emotionally disturbed by the Alachua County School Board were selected for the study. Two subjects per class period were selected from those students that:

1. were currently experiencing behavioral difficulties in the class following their resource room time. A behavioral difficulty was defined as being sent to time-out two or more times in one week.
2. were enrolled in a special education class for the class period immediately following the resource room time.

Additional information concerning the subjects is presented in Appendix A.

Apparatus

The students were responsible for any equipment used during running. Jogging was done on a quarter-mile course established by the experimenter.

Talk outs were recorded by an observer for 50 minutes daily. A second observer provided three observations in order to establish interobserver agreement. Both observers used the observation form displayed in Figure 1. The student's name along with the observer's name was entered on the sheet. Accompanying this was the total length of time the student was observed. The numerical blocks indicated the five minute segments of the observation period. The observers were facilitated by a stop watch in keeping track of the time periods. The observers submitted their observations daily to the experimenter.

Time	5	10	15	20	25	30	35	40	45	50	Total
Talk outs											

Subject's Name __________________________

Observer's Name __________________________

Date __________________________________

Figure 1

Observation Form

The number of completed tasks and teacher ratings were recorded daily by the experimenter. The classroom teacher received a daily list of the students participating in the experiment. She recorded the number of tasks completed each day as well as a rating of the student's behavior. Figure 2 illustrates the form used.

Dean's reports were collected daily. The form, seen in Figure 3, was submitted to the Dean of Students who recorded the number of times the subject was seen in his office for discipline problems. Data collected during these observations are presented in Appendix B.

Date: ______________________

Subject	Work Done	Rating 1-Terrible 2-OK 3-Great
1		
2		
3		
4		
5		
6		

Figure 2

Completed Task and Teacher Rating Form

Date: ______________________

Subject	Number of Dean's Reports
1	
2	
3	
4	
5	
6	

Figure 3

Dean's Reports Form

Setting

The training in this study took place at Lincoln Middle School, Gainesville, Florida. Each subject was selected from a resource room for the emotionally handicapped. Individualized social studies instruction was given in this class to a maximum of eight students. Observations indicated that the students were consistently completing at least two of the three tasks assigned daily. During the following class period the behavioral measurement took place in a non-categorical special education class. This class had no more than eight students per class period. Students received instruction in either language arts or math in this setting.

Treatment

Several experimental conditions were examined in this investigation. Due to the time constraints of a 50 minute class period, a 15 minute experimental session at the beginning of the period was used. The subjects were told that they had been selected to participate in a jogging club. The students supplied their own equipment. Two different subjects participated in each of three class periods. During two of the class periods, one subject was accompanied by the experimenter to a one-quarter mile preestablished track on the school grounds and told to jog as far as he could in 15 minutes. Following the session the student was accompanied to his original class. This procedure was repeated the last 15 minutes of the class for the second subject. In the other class period, both subjects were under different experimental conditions. One subject was in the jogging condition while the other subject was in another treatment or baseline phase. Each subject, therefore, was jogging at a different time. At the end of each week, each student was allowed to review a record of his distance run.

To more fully explore any controlling variables, several other interventions were examined. The second experimental condition examined was reading outside. The subjects selected a social studies book and read outside with the experimenter for 15 minutes. The subjects were told that by reading outside, there would be less interfering noise than in the classroom. The outdoor reading treatment was instituted to determine if any effect occurred when the subjects were allowed to engage in a non-physical outdoor activity.

Two other interventions were added in order to determine if other variables and forms of exercise other than jogging would affect classroom behavior. In two of the classes, the entire class to which the subjects were assigned, was asked if they would like to play touch football outside for the last 15 minutes of the class period. The students were told that they had completed their class work and, therefore, deserved some special reward for their efforts. Both classes agreed to this. The first intervention, called losing football, began with the experimenter choosing teams of four in such a way as to give an unfair advantage to the group without the two experimental subjects. This, coupled with the experimenter's officiating, assured the subjects of a losing football game. The touch football sessions were vigorous and lasted 15 minutes. In the second intervention of this type, winning football, the experimenter chose teams, and officiated in such a manner, so as to cause the team with the two subjects to win. Complaints concerning team selection and officiating were explained as being either "good luck" or "bad luck." In the third class, the same procedure was followed except only one subject was targeted for investigation. The other experimental subject in that class period was in a different experimental phase and was excluded from participation in the game. This did not pose any experimental difficulty, however, in that the excluded subject voiced an objection to participating in football games.

Experimental Design

The design used in this study is an extension of the basic ABA design (Bailey & Bostow, 1979; Hersen & Barlow, 1976). The design was expanded and replicated across subjects so as to allow for a more extensive analysis of possible intervening variables.

Three of the subjects began, during the pilot study, a baseline phase followed by an experimental condition of jogging. A reversal to the previous baseline condition then occurred followed by reinstituting the experimental jogging phase and ending with a return to baseline. The experimenter then added to this design by instituting an outdoor reading treatment followed by the winning football treatment. A return to baseline then occurred and was followed by the losing football condition. These conditions are summarized below and illustrated in Figure 4.

A — Baseline phase, no treatment

B — 15 minute jogging

A — Reversal phase, return to baseline

B — 15 minute jogging

A — Reversal phase, return to baseline

C — Reading outside

D — Winning football

A — Reversal phase, return to baseline

E — Losing football

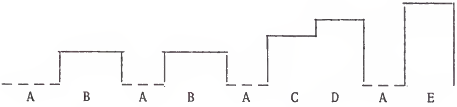

Figure 4

Experimental Phases for Subjects 1, 2, and 3

Baseline data were collected on three additional subjects during the pilot study. This baseline phase was followed by an experimental jogging treatment. Baseline was then reinstituted and was again followed by a jogging condition. The experiment ended with the outdoor reading treatment. Winning and losing football were not examined. These conditions are summarized below and detailed in Figure 5.

A — Baseline

B — 15 minute Jogging

A — Reversal phase, return to baseline

B — 15 minute Jogging

A — Reversal phase, return to baseline

C — Outdoor reading

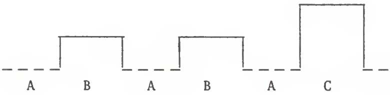

Figure 5

Experimental Phases for Subjects 4, 5, and 6

During the experimental phases, the subject left the room with the experimenter and engaged in the assigned activity for 15 minutes. Following this, the subject was returned to class to await the beginning of the next period's class which was a non-categorical special education class.

In one class, two subjects followed the order of treatments illustrated in Figure 4. In another class, two of the subjects followed the order of treatments listed in Figure 5. In the third class, one subject followed the conditions in Figure 4 while the other student followed the conditions shown in Figure 5. As a result, in the third class, the two subjects were always at different experimental stages. This presented no experimental problems.

Stability, or steady state, of data is a crucial factor in behavioral research. A steady state may be said to exist when relatively little variability is present in data over a period of time (Johnston & Pennypacker, 1980). No fixed rules have been established for determining the presence of steady state responding (Sidman, 1960). A researcher's past experiences, pilot studies, and previous research may, however, aid in establishing criteria for the stability of data. Given the lack of reported data in the literature, for the purpose of this research, a steady state was said to exist if, when measuring talk outs, five consecutive data points in an experimental condition yield a Kappa value not exceeding 1.6. Kappa, introduced by Johnston and Pennypacker (1980), is recognized as being an appropriate means of measuring stability of data in single case research.

Talk outs represented greater variability than any other measure in this investigation. As the data in Chapter IV demonstrate, talk outs range from 72 to 0 per class session. A problem was encountered with computing Kappa during the course of this investigation. With extremely small numbers, the geometric proportions of Kappa caused extremely high values to be obtained. Work done and dean's reports were always small numbers. Talk outs represented larger numbers with more variability. Bringing talk outs under control, therefore, provided the best measure of steady state responding. Refer to Appendices A and B in Strategies and Tactics of Human Behavioral Research (Johnston & Pennypacker, 1980) for a more detailed description of computing Kappa.

Dependent Variables

Four dependent variables were measured:

1. Talk outs: any verbalization without teacher permission.
2. Dean's Reports: the number of times per day the subject was sent to the Dean of Students for misbehavior.
3. Teacher Ratings: the rating the non-categorical special education teacher gave the subject.
4. Completed Written Assignments: the number of teacher assigned written tasks completed per class session by the subject.

A classroom aide in the non-categorical special education classroom served as the primary observer of talk outs. The aide and the classroom teacher were unaware of the existing experimental conditions. An undergraduate student from the Department of Special Education was used to establish inter-observer agreement. The observers were trained previously to record student behavior. Training consisted of establishing an 85 percent level of agreement through observation of the targeted behaviors (see Appendix C). The observation sheets were marked and turned in daily to the experimenter. A second observer was used on three occasions to establish agreement.

An agreement measure was completed three times during the course of the experiment. An 85 percent level of agreement was considered successful. The percentage of agreement was computed by dividing the smaller number by the larger number for each cell and multiplying by 100. This percentage reflected the amount of agreement for that cell between the two observers. This procedure was repeated for each cell and then averaged to obtain an interobserver agreement score (Bailey & Bostow, 1979). An illustration of the method of computing interobserver agreement is provided in Figure 6. See Appendix C for agreement scores.

Behavior: Talk Outs Subject: 1

Minutes:	5	10	15	20	25	30	35	40	45	50
Observer 1	6	5	7	8	9	8	7	6	8	5
Observer 2	6	4	6	8	9	7	8	6	8	5
Agreement	100%	80%	86%	100%	100%	87.5%	87.5%	100%	100%	100%

Average Agreement: 84.1%

Figure 6

Interobserver Agreement Form

By collecting teacher ratings and dean's reports on each subject, a more careful analysis of the intervening variables was allowed. These reports were collected daily.

Independent Variables

The subjects had 15 minutes of sustained forward movement around a quarter-mile jogging course under the supervision of a teacher's aide. Records were kept of the distance run per day and shared only with the subjects at the end of each week. The normal classroom contingencies were in effect during the jogging session. Several other independent variables were added during the course of the investigation. Outdoor reading was added to assess any effects non-physical outdoor activity might have on the behavior of the subjects. Each subject, during the outdoor reading phase, selected a social studies book that he would enjoy. The subject then accompanied the experimenter outside for a 15 minute reading session.

Winning and losing football treatments were instituted to determine if other forms of physical activity affected classroom behavior. In addition to his, the football conditions allowed for the examination of the effects of participating in a winning or losing effort. Procedures for establishing the winning and losing football teams were previously described in this chapter in the Treatment section.

Data Analysis

The recorded data in this study reflected the appropriate dimensional quantities of the classroom behavior under investigation. Talk outs were counted over a 50 minute period of time. The rate of talk outs was tabulated and recorded on the Standard Behavior Chart. The mean scores and frequency multipliers of talk outs for each experimental condition were computed in order to analyze the data. The ratio multipliers are used to describe the amount of change in the dependent measure across phases (Pennypacker, Koenig, & Lindsley, 1972).

The number of completed written assignments, dean's reports, and teacher ratings were computed daily and displayed on an equal interval chart. The mode of teacher ratings, mean of dean's reports, and percentage of completed written assignments were tabulated for each experimental condition.

In order to strengthen any conclusions drawn from this investigation, correlation coefficients were computed between all dependent measures. By doing this, relationships between dependent variables were investigated.

Summary

Jogging represents a potentially valuable tool to help emotionally disturbed youth. It should not be consided a potential panacea, but rather a possible contributor to improved service delivery models for behavior disordered youth. This investigation does not end the discussion of the efficacy of jogging. Instead, it should provide a stimulus for further research.

CHAPTER IV

RESULTS

This study investigated the effects of physical activity on the classroom work and talk outs of six emotionally handicapped adolescents. Six students were selected in accordance with the criteria set forth in Chapter III. Individual data were collected daily on the number of talk outs per class period, teacher ratings of the student, number of dean's reports per day, and number of written tasks completed. The raw data are presented in Appendix B. Five measures were used for analysis of the data: mean, mode, percent, ratio multipliers, and correlation coefficients.

Interobserver Agreement

Interobserver agreement was computed by the Block-by-Block method (Bailey & Bowstow, 1979) described in the previous chapter. The results of the observer agreement checks are presented in Appendix C. In all interobserver situations, the minimum requirement of 85 percent agreement was met.

Steady State

Steady state responding was determined by computing Kappa (Johnston & Pennypacker, 1980) for each experimental period. The results are presented in Table 3. The critical value of 1.6 was not exceeded in any experimental phases.

Table 3

Kappa Coefficients for All Experimental Phases

Experimental Phases	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6
A	1.108	1.057	1.116	1.020	1.252	1.065
B	1.123	1.187	1.144	1.040	1.518	1.275
A	1.073	1.112	1.124	1.036	1.109	1.085
B	1.516	1.379	1.245	1.339	1.319	1.189
A	1.149	1.111	1.134	1.024	1.042	1.075
C	1.095	1.126	1.089	1.022	1.028	1.040
D	1.275	1.116	1.143			
A	1.040	1.188	1.078			
E	1.176	1.176	1.229			

Distance Run During Jogging

The mean number of miles run per day during the jogging phase of the experiment is illustrated in Table 4. An increase in distance run was noted in five of the six subjects.

Table 4

The Mean Number of Miles Run of Each Subject

Phase	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6
B 1st Jogging Phase	1.15	1.375	1.19	1.6	1.0	1.48
B 2nd Jogging Phase	1.44	1.54	1.07	1.69	1.04	1.5

Subject 1

Subject 1 jogged slowly at all times but never stopped during any of the sessions. An increase in distance run is demonstrated in Table 4.

Subject 2

Subject 2 chose to run at a quick pace and then walk for a short distance. This pattern remained throughout the experiment. An increase in distance run is illustrated in Table 4.

Subject 3

Subject 3 would jog at a slow pace and then walk for a considerably longer distance. At no time did he stop. As shown in Table 4, a decrease in the distance run was noted in the second jogging phase.

Subject 4

Subject 4 jogged at a moderate to quick pace the entire time. At no time did he stop or jog slowly. An increase is noted in the distance run in Table 4.

Subject 5

Subject 5 would jog at a slow pace and then walk a short distance. It appeared that his walking pace was faster than his jogging pace. A slight increase in distance run is demonstrated in Table 4.

Subject 6

Subject 6 would jog at a relatively quick pace and then walk a short distance. This pattern continued throughout the experiment. A slight improvement is indicated in Table 4.

Introduction to Subjects

Data for Subject 1, 2, and 3 were collected during the pilot study for the following conditions: baseline (A), jogging (B), baseline (A), jogging (B), and baseline (A). Following the pilot study, four additional conditions were examined: outdoor reading (C), a winning team member in a football game (D), baseline (A), and a losing team member (E). Baseline data for Subjects 4, 5, and 6 were collected during the pilot study. The following conditions were also examined subsequent to the pilot study: jogging (B), baseline (A), jogging (B), baseline (A), and outdoor reading (C). Due to time constraints, these subjects did not receive winning and losing football.

The purpose of this chapter is to report the results obtained during the study. The data are reported in relation to questions under investigation.

Problem 1

The question under investigation was: Is there a relationship between a jogging program and change in the number and rate of talk outs? A classroom observer recorded each occurrence of a talk out. This measure, accompanied by periodic observations from another observer, provided an assessment of the number of talk outs per class period.

Two additional measures related to school behavior were collected. Daily teacher ratings of the individual subject's classroom behavior provided a measure of the teacher's opinion concerning the quality of the student's classroom behavior. While this is not a direct measure of behavior, teacher ratings allowed an analysis of the teacher's impressions of the student's behavior. Daily reports from the Dean of Students offered a measure of the number of serious disciplinary offenses occurring daily in all school settings.

Subject 1

Subject 1 was a 13 year old seventh grade white male. Additional information concerning Subject 1 is contained in Appendix A.

Talk outs. The rate of talk outs per 50 minutes of class period is illustrated in Figure 7. In the initial baseline phase of 16 days, initial variability in the data was replaced by stable responding during the final nine days. Day 17, the first day of jogging, witnessed an increase to seven talk outs in 10 minutes (.7). The following day, four talk outs occurred, a .08 rate, followed by nine days of similarly low responding. An increase in talk outs was noted when baseline conditions were reinstituted. The number fell significantly, however, upon return to the jogging condition.

On day 45, baseline conditions were resumed for five days and were followed by five days in which the subject read a selected book outside by himself. The data during this phase resembled the data from the previous baseline condition. Data from the winning and losing football conditions were similar to those obtained during the jogging phase. An analysis of the data presented in Table 5 indicates that mean talk outs of 6.81 and 2.89 per class period obtained during the jogging condition are statistically different from the mean talk outs of 22.26, 25.5, 26.2, and 20.0 noted during baseline conditions. Mean talk outs of 26.8 during the outdoor reading phase indicate no statistical significance. The greatest statistically significant difference and lowest mean talk outs were noted in the winning football (2.6) and losing football (2.8) conditions.

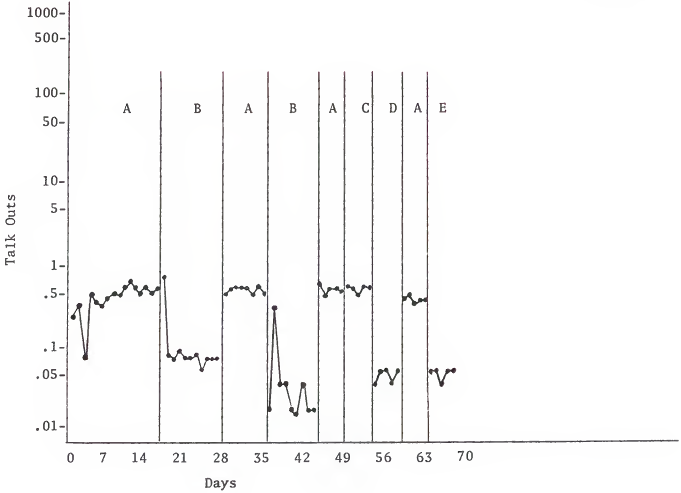

Figure 7

Rate of Talk Outs of Subject 1

Table 5

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 1

	Experimental Phase								
Measure	A	B	A	B	A	C	D	A	E
$\bar{x}$ Talk Outs	22.26	6.81	25.5	2.89	26.2	26.8	2.6	20.0	2.8
$\bar{x}$ Dean's Reports	.875	.18	.375	.33	3.25	1.2	2.0	2.4	.6
M Teacher Rating	1.5	3	2	3	2	1.5	3	1.5	3

Teacher ratings. The daily teacher ratings of Subject 1 are presented in Figure 8. The subject did not receive any ratings of 3 during the first sixteen days of baseline conditions. A mode of 1.5 for teacher ratings during the initial baseline is indicated in Table 5. Mode scores of 3 were given for both jogging conditions as well as the winning and losing football phases. All baseline and outdoor reading mode scores were lower than 3.

Dean's reports. The daily number of dean's reports is presented in Figure 8. A trend of increased reports was noted following day 45. It is shown in Table 5 that the mean number of Dean's reports per day dropped from .875, during the initial baseline period, to .18 in the jogging phase. An increase to .375 was noted when baseline conditions were resumed. A small drop to .33 occurred following the reinstitution of jogging. The baseline phase from day 45 to day

49 witnessed the highest mean number of dean's reports during the entire experiment. A decrease to 1.2 dean's reports per day occurred during the outdoor reading phase, but was followed by an increase to 2.0 in the winning football condition. In the following baseline condition, there was a further increase to 2.4. The subject concluded the experiment with .6 dean's reports per day in the losing football condition.

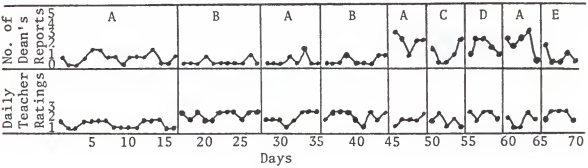

Figure 8

Daily Dean's Reports and Teacher Ratings of Subject 1

Summary of Subject 1. An examination of the data presented in Figure 9 indicates that the mean number of talk outs during the jogging and both football conditions were significantly lower than those scores obtained during baseline. No significant differences are noted for the outdoor reading phase. Teacher ratings reflected the improvement in talk outs in that the mode score of 3 for teacher

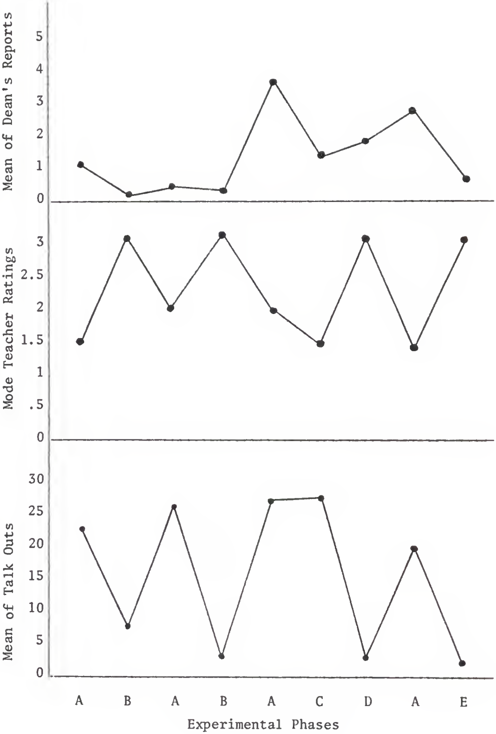

Figure 9

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 1

ratings during the jogging and both football conditions was higher than for the baseline periods or outdoor reading phase. The lowest mean number of dean's reports per day occurred during the first jogging condition. However, significantly different scores occurred only during the first jogging and the losing football sessions.

Subject 2

Subject 2 was a 13 year old eighth grade white male. Additional information concerning Subject 2 is provided in Appendix A.

Talk outs. The daily rate of talk outs per class period for Subject 2 is demonstrated in Figure 10. The initial variability in baseline responding was replaced by stable responding over the last 10 days of this period. A decrease in talk outs was noted in the jogging conditions as well as both football phases. The highest recorded rate of talk outs, however, occurred on day 39 during the jogging condition. The talk-out rate fell the following day to .12 and stayed in that range for the remainder of the experimental condition.

The mean number of talk outs per class period is illustrated in Table 6. Scores obtained during jogging (6.2, 10.0), winning football (5.6), and losing football (5.0) are statistically significant when compared to the mean scores (24.4., 20.67, and 21.0) obtained during baseline. A mean talk out of 19.2 during outdoor reading was not significantly different from baseline mean scores.

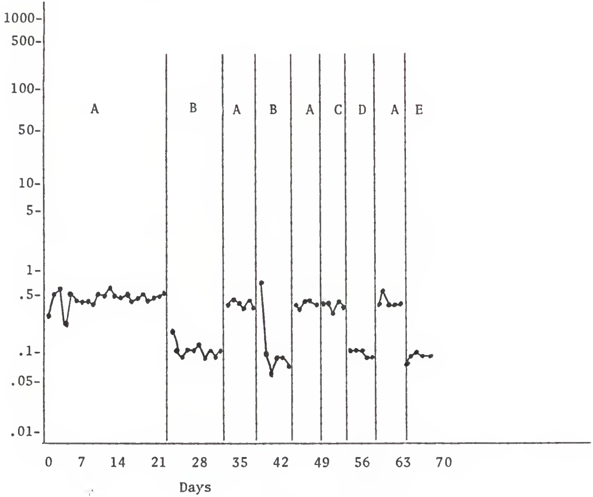

Figure 10

Rate of Talk Outs of Subject 2

Table 6

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 2

	Experimental Phase								
Measure	A	B	A	B	A	C	D	A	E
$\bar{x}$ Talk Outs	24.4	6.2	20.67	10.0	21.0	19.2	5.6	22.4	5.0
$\bar{x}$ Dean's Reports	1.64	2.0	1.5	1.33	1.6	2.4	1.6	2.2	1.2
M Teacher Rating	1	3	2	3	3	1	3	1.5	3

Teacher ratings. The daily teacher ratings are displayed in Figure 11. A mode of 3 for teacher ratings during jogging conditions as well as both football phases is indicated in Table 6. These ratings were consistently higher than the mode ratings of 1, 2, 3, and 1.5 noted for baseline conditions and the mode rating of 1 for outdoor reading.

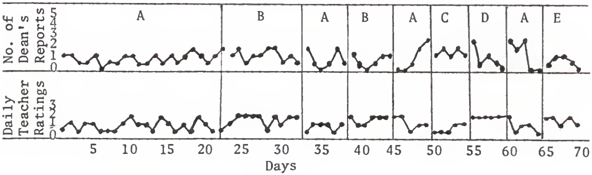

Figure 11

Daily Dean's Reports and Teacher Ratings of Subject 2

Dean's reports. The daily dean's reports are presented in Figure 11. An analysis of the mean number of reports presented in Table 6 indicates no significant differences between those scores obtained during baseline, jogging, either football condition, or outdoor reading.

Summary of Subject 2. A summary of mean talk outs, mode ratings, and mean number of dean's reports per experimental condition is presented in Figure 12. Statistically significant differences were noted when comparing those scores obtained during baseline conditions to those in jogging and winning and losing football. No significant differences were noted when comparing the mean outdoor reading scores. An analysis of teacher ratings indicates that highest ratings occurred during jogging and both football conditions. No significant differences were found in the mean number of dean's reports.

Subject 3

Subject 3 was a 13 year old eighth grade white male. Additional information concerning Subject 3 is provided in Appendix A.

Talk outs. The daily rate of talk outs per class period is presented in Figure 13. An acceptable amount of stability is noted with the exception of days 17 and 26. The data from these two days are appreciably different from those obtained during the remainder of their respective conditions.

An examination of the scores presented in Table 7 indicates that mean talk outs of 7.22 and 6.28 obtained during jogging are significantly different from 12.31, 14.33, 15.8, and 19.2 mean talk outs

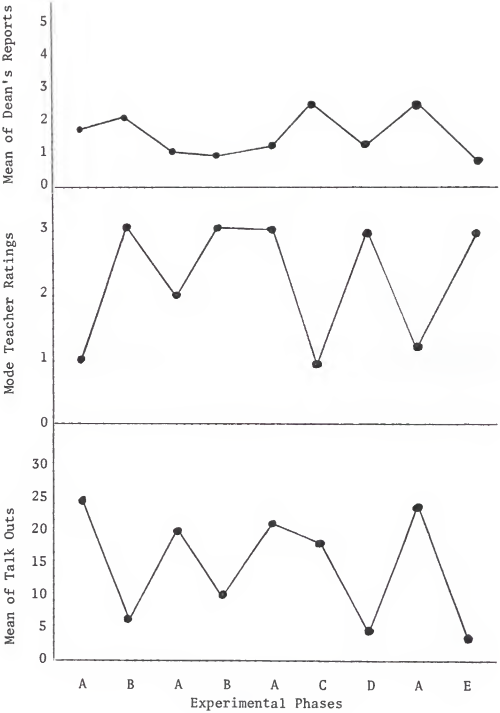

Figure 12

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 2

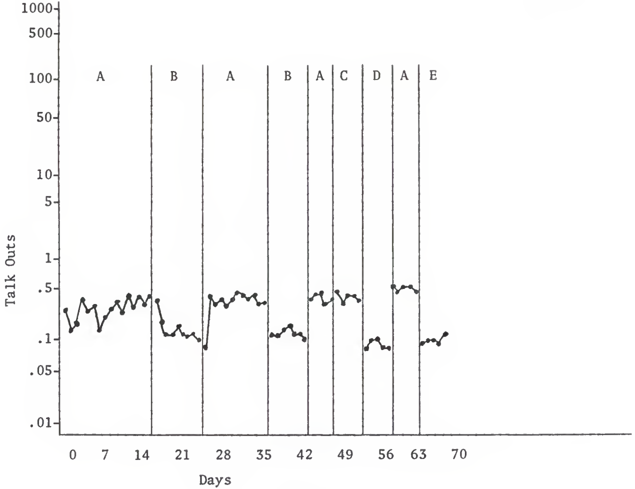

Figure 13

Rate of Talk Outs of Subject 3

Table 7

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 3

	Experimental Phases								
Measures	A	B	A	B	A	C	D	A	E
$\overline{x}$ Talk Outs	12.31	7.22	14.33	6.28	15.8	16.0	4.4	19.2	4.8
$\overline{x}$ Dean's Reports	.94	.3	.25	.29	1.8	1.6	.6	.6	.6
M Teacher Rating	1	3	1	3	1.5	2	2	2	3

from the baseline phase. Mean talk-outs of 4.4 from the winning football phase and 4.8 for the losing phase were significantly lower than baseline mean scores. A score of 16.0 for the outdoor reading phase represented the highest mean number of talk outs during the course of the experiment.

Teacher ratings. Daily teacher ratings of Subject 3 presented in Figure 14, and the mode of teacher ratings, illustrated in Table 7, indicate ratings of 3 for the jogging and losing football conditions as well as a mode of 2 for the winning football and outdoor reading condition. During baseline conditions, scores of 1, 1, 1.5, and 2 were reported.

Dean's reports. Daily dean's reports, presented in Figure 14, indicate that greater numbers of dean's reports occurred from days 45-54. The data presented in Table 7 indicate that the lowest mean number of dean's reports occurred during the second baseline period (.25) and was closely followed by mean scores of .3 and .29 for the jogging conditions. These scores are significantly lower than the mean score of .94 obtained during the initial baseline period. Mean dean's reports of 1.8 for the third baseline condition and 1.6 for outdoor reading were significantly higher than those data from other conditions. Mean scores of .6 dean's reports per day were noted for the winning football, losing football, and final baseline conditions.

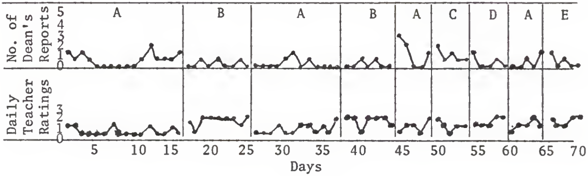

Figure 14

Daily Dean's Reports and Teacher Ratings for Subject 3

Summary of Subject 3. An analysis of data presented in Figure 15 indicates that the mean number of talk outs was significantly lower for the jogging and both football conditions. No difference was noted for the outdoor reading phase. Mode scores of 3 during jogging and losing football as well as modes of 2 for outdoor reading and winning football are demonstrated in Figure 15. These scores were higher than the mode scores obtained during baseline conditions. The mean number of dean's reports indicated a great deal of variability in that under baseline conditions, the highest and lowest scores were reported. The mean number of dean's reports obtained during jogging, winning football, and losing football were similar to those in baseline conditions.

Subject 4

Subject 4 was a 13 year old seventh grade black male. Additional information concerning the subject is contained in Appendix A.

Talk outs. The data presented in Figure 16 suggest a marked amount of variability in responding. Significant peaks and valleys are noted in the data until the final two experimental periods. As illustrated in Table 8, mean talk outs of 43.2 and 17.22 during the jogging phase were lower than the 67.25, 65.56, and 50.0 scores obtained during baseline. A mean talk out score of 45.4 from the outdoor reading phase was significantly lower than those scores from baseline conditions.

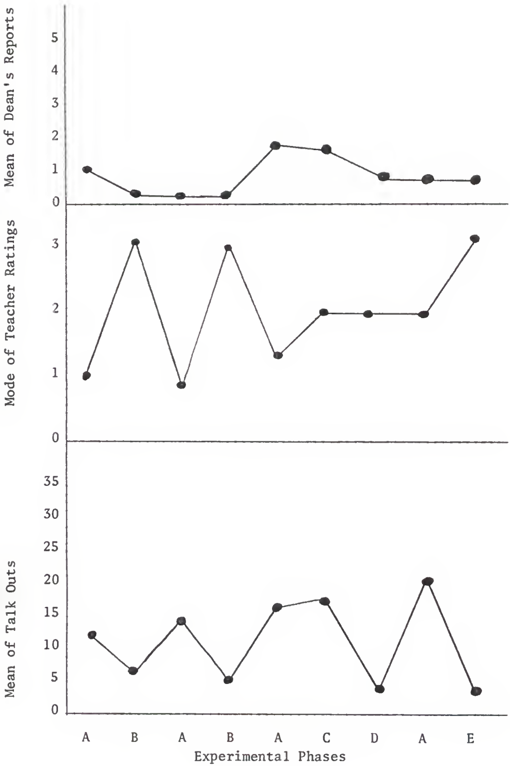

Figure 15

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 3

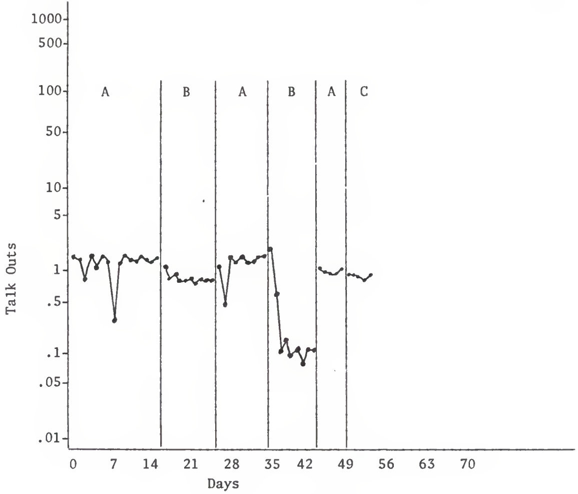

Figure 16

Rate of Talk Outs of Subject 4

Table 8

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 4

	Experimental Phases					
Measures	A	B	A	B	A	C
$\bar{x}$ Talk Outs	67.25	43.2	65.56	17.22	50.0	45.4
$\bar{x}$ Dean's Reports	2.0	1.5	2.22	1.11	2.8	1.6
M Teacher Ratings	1.5	3	2	3	2	2.5

Teacher ratings. The daily teacher ratings, shown in Figure 17, and the mode of teacher ratings represented in Table 8, indicate a mode of 3 for both jogging phases, and 2.5 for the outdoor reading phase. Mode scores of 1.5, 2, and 2 were noted for the baseline conditions.

Dean's reports. The daily number of dean's reports, shown in Figure 17, and the mean number of dean's reports per experimental condition in Table 8, indicate lower scores for both the jogging and outdoor reading session. Mean scores of 1.5 and 1.11 for the jogging condition, as well as the 1.6 mean score for outdoor reading, are significantly lower than the 2.0, 2.22, and 2.8 mean baseline scores.

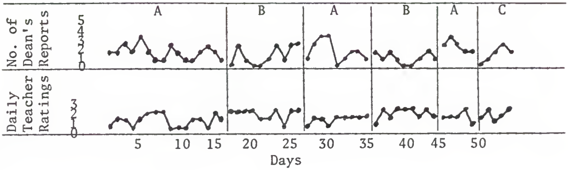

Figure 17

Daily Dean's Reports and Teacher Ratings of Subject 4

Summary of Subject 4. An analysis of the data illustrated in Figure 18 indicates the mean number of talk outs were significantly lower for the jogging and outdoor reading phases. Teacher ratings were highest for both jogging conditions and the mean number of dean's reports was significantly lower for both the jogging and outdoor reading sessions.

Subject 5

Subject 5 was a 12 year old sixth grade while male. Additional information concerning Subject 5 is contained in Appendix A.

Talk outs. As indicated in Figure 19, the rate of talk outs per day was relatively stable within experimental conditions with the exception of days 3 and 23. An examination of the data presented in Table 9 indicates that mean talk outs of 3.4 and 2.5 for the jogging phases are significantly lower than the 7.0, 18.33, and 14.6 mean talk outs of the baseline period. The highest mean talk outs were reported with the outdoor reading phases.

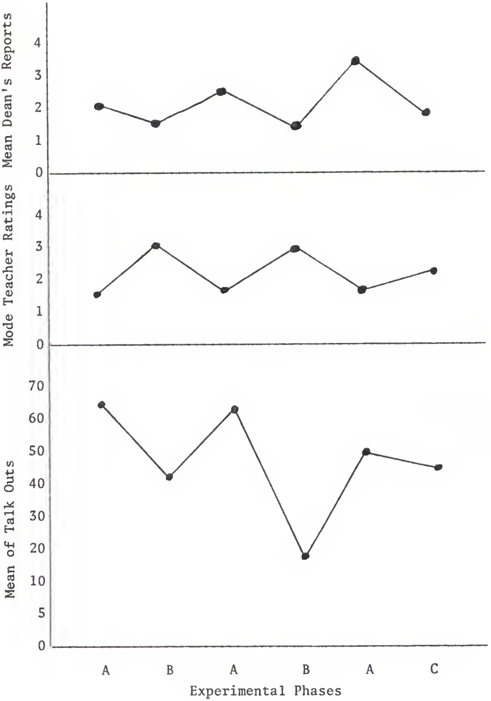

Figure 18

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 4

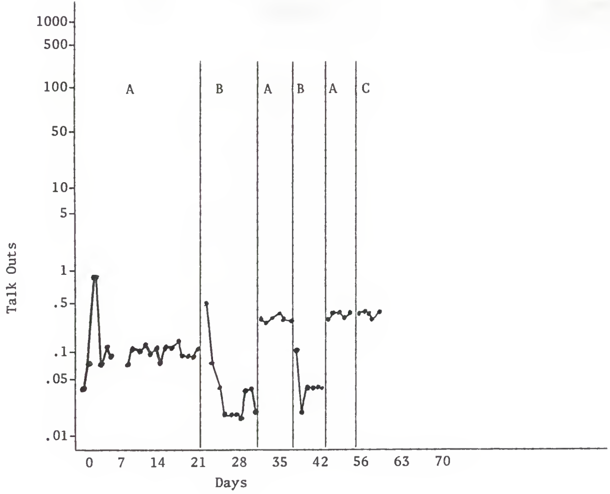

Figure 19

Rate of Talk Outs of Subject 6

Table 9

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 5

Measures	A	B	A	B	A	C
	Experimental Phases					
$\bar{x}$ Talk Outs	7.0	3.4	18.33	2.5	14.6	14.8
$\bar{x}$ Dean's Reports	1.57	.7	.167	.167	.8	1.2
M Teacher Ratings	2	3	2	3	2	2

Teacher ratings. The daily teacher ratings represented in Figure 20 and mode scores in Table 9 indicate ratings of 3 during the jogging phase as compared to ratings of 2 for each of the baseline as well as the outdoor reading phases.

Dean's reports. It is demonstrated in Figure 20 and Table 9 that the greatest mean number of dean's reports occurred during the initial baseline phase (1.57). The lowest mean number of reports (.167) occurred during both the second baseline and second jogging phases.

Summary of Subject 5. An examination of the scores illustrated in Figure 22 indicates that the mean number of talk outs were significantly lower during the jogging phase. Teacher ratings were significantly higher for the jogging session. However, no clear patterns were established with the number of dean's reports.

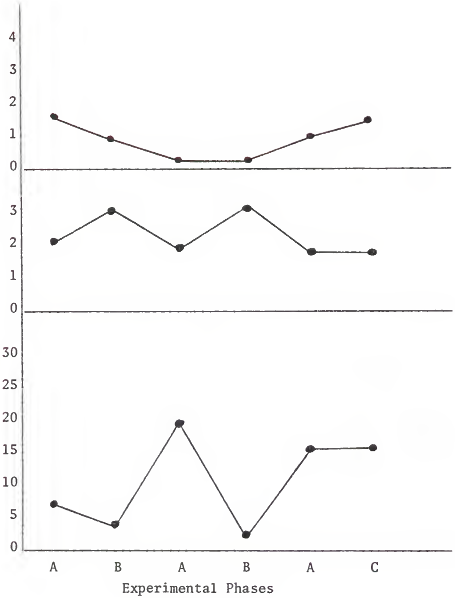

Figure 21

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 5

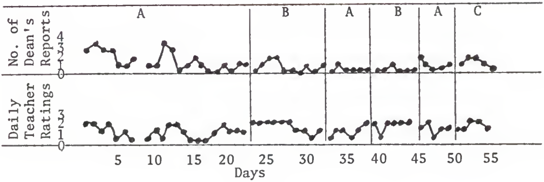

Figure 20

Daily Dean's Reports and Teacher Ratings of Subject 5

Subject 6

Subject 6 was a 13 year old seventh grade white male. A complete description of Subject 6 is provided in Appendix A.

Talk outs. As illustrated in Figure 22, the initial variability in the baseline phase was replaced by stable responding with the exception of day 27. An examination of the data presented in Table 10 indicates that mean talk outs of 5.83 and 3.6 for the jogging phases were significantly lower than the 46.9, 35.2, and 30.4 mean talk outs for the baseline phase and the 30.2 score obtained during the outdoor reading condition.

Teacher ratings. The daily teacher ratings demonstrated in Figure 23 as well as mode scores in Table 10 indicate ratings of 3 for both jogging conditions and scores of 1, 2, and 2, respectively, for baseline phases. The mode score of the outdoor reading phase was 1.5.

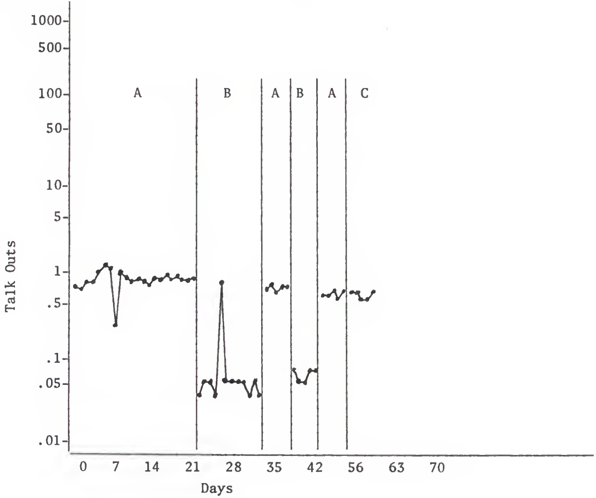

Figure 22

Rate of Talk Outs of Subject 6

Table 10

Mean Number of Talk Outs, Mean Number of Dean's Reports, and Mode of Teacher Ratings of Subject 6

Measures	Experimental Phases A	B	A	B	A	C
$\overline{x}$ Talk Outs	46.9	5.83	35.2	3.6	30.4	30.2
$\overline{x}$ Dean's Reports	1.18	1.25	2.2	1.2	2.2	2.4
M Teacher Ratings	1	3	2	3	2	1.5

Dean's reports. It is demonstrated in Table 10 and Figure 23 that the lowest mean number of dean's reports occurred during the initial baseline periods (1.18). Scores of 1.25 and 1.2 were noted for both jogging sessions. These scores were lower than the 2.2 and 2.2 mean scores of the remaining two baseline sessions and the 2.4 score of the outdoor reading session.

Summary of Subject 6. An analysis of data in Figure 24 indicates that significantly lower mean talk-outs were reported for the jogging sessions when compared to both the baseline and outdoor reading conditions. Teacher ratings were highest during the jogging conditions, however, the mean number of dean's reports was slightly higher than the mean score from the initial baseline phase.

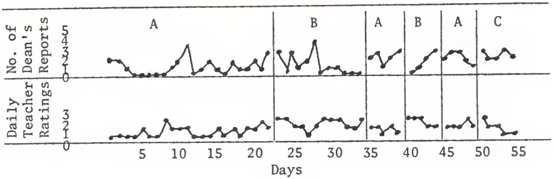

Figure 23

Daily Dean's Reports and Teacher Ratings of Subject 6

Summary of Problem 1

The mean talk outs of all subjects were lower for the jogging sessions when compared to those scores obtained during baseline conditions. The lowest scores, however, were reported with the winning and losing football conditions. The lowest number of mean talk outs of two of the three subjects occurred during winning football. The frequency multipliers for talk outs are provided in Appendix D. Teacher ratings for all subjects were highest during the jogging and both football sessions. Variability was noted across experimental conditions in the mean number of dean's reports.

An examination of the relationship between the dependent measures indicates that talk outs had a .497 correlation to dean's reports, -.45 relationship to teacher ratings, and a -.42 correlation

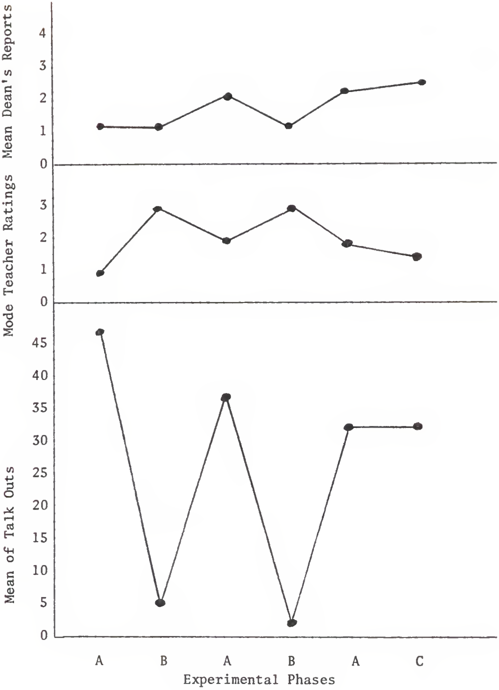

Figure 24

Mean Number of Dean's Reports, Mode of Teacher Ratings, and Mean Number of Talk Outs of Subject 6

to completed written assignments. Dean's reports had a -.29 correlation to teacher ratings and a -.22 relationship to completed written assignments.

Problem 2

The question under investigation is: Is there a relationship between a jogging program and the number of completed written assignments? The subjects were assigned four written tasks daily that would require the entire period to complete. These assignments were collected daily and dated for record keeping purposes. No criterion for accuracy was established. A second measure, time on task, was abandoned when it was found that the stopwatch being used was faulty.

Subject 1

Subject 1 was assigned math problems. Data presented in Figure 25 displays the number of assignments completed per class session. An analysis of these data suggests that a significantly greater number of assignments were completed during the jogging and both football sessions. As shown in Table 11, 88.6 percent and 55.5 percent of the assigned tasks were completed during the jogging sessions versus 28.0 percent, 37.5 percent, 40.0 percent, and 20.0 percent during baseline conditions. Significant differences were noted in the football treatments in that 65 percent of the tasks were completed in the winning football and 60 percent in the losing football phases, while only 40 percent were completed during outdoor reading.

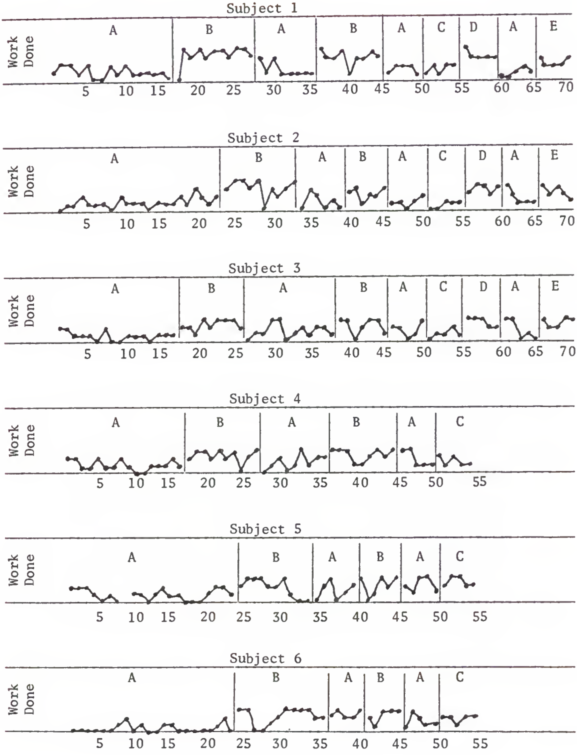

Figure 25

Number of Written Tasks Completed Daily of All Subjects

Table 11

Percentage of Work Completed Per Experimental Condition for All Subjects

Condition	Measure	Subject 1	2	3	4	5	6
A	% Work Done	28.0	29.5	23.4	29.6	25.0	10.0
B	% Work Done	88.6	75.0	58.3	57.5	47.5	52.0
A	% Work Done	37.5	25.0	35.0	33.0	33.0	60.0
B	% Work Done	55.5	29.0	53.5	63.9	50.0	60.0
A	% Work Done	40.0	25.0	40.0	45.0	50.0	40.0
C	% Work Done	40.0	15.0	25.0	20.0	60.0	65.0
D	% Work Done	65.0	65.0	65.0			
A	% Work Done	20.0	40.0	35.0			
E	% Work Done	60.0	55.0	65.0			

Subject 2

Subject 2 was assigned math problems. Data from Figure 25 and Table 11 suggest that increased numbers of assignments were completed during the jogging and both football sessions. Significantly improved scores were noted in the first jogging treatment (75 percent), winning football (65 percent), and losing football phases (55 percent). Percent of tasks completed during baseline conditions was 29.5 percent, 25 percent, 25 percent, and 40 percent. The second jogging condition recorded 29 percent of tasks completed, while 15 percent of tasks were completed during the outdoor reading phase.

Subject 3

Subject 3 was assigned language arts work. An analysis of the data indicates that scores of 58.3 percent and 53.5 percent for jogging, 65 percent for both winning and losing football are significantly higher than the 23.4 percent, 35 percent, 40 percent, and 35 percent scores reported in Table 11 for baseline conditions. No differences were noted for the outdoor reading phase. The number of assignments completed daily is illustrated in Figure 25.

Subject 4

Subject 4 was assigned language arts work. The daily number of written tasks completed, as presented in Figure 25, indicates that low levels of initial responding were replaced by higher levels during the jogging phase. An examination of the data illustrated in Table 11 shows the 57.5 percent and 63.9 percent scores obtained during jogging are significantly higher than the 29.6 percent, 33 percent, and 45 percent scores recorded during baseline. The scores obtained during the outdoor reading phase were not significantly different from those obtained during the baseline phase.

Subject 5

Subject 5 was given language arts work. As demonstrated in Figure 25, a low number of tasks were initially completed. Improvement began on day 23 and continued to various degrees throughout the remainder of the experiment. An analysis of the data illustrated in Table 11 indicates that the 47.5 percent and 50 percent of task completed scores noted during the jogging sessions are significantly different from the first 25 percent and 33 percent scores of the first two baseline periods. A 50 percent task completion score was recorded during the final baseline phase. During the outdoor reading treatment, however, the highest percentage of 60 percent was recorded.

Subject 6

Subject 6 was assigned language arts work. As indicated in Figure 26, there were more days in which all work was completed during the first jogging phase than during any other experimental condition. The 52 percent and 60 percent work completed scores presented in Table 11 for the jogging phases are higher than the 10 percent initial baseline score. Further examination reveals, however, that 60 percent of the work was completed during a baseline condition and 65 percent during the outdoor reading phase.

Summary of Problem 2

An analysis of the data indicates a higher percentage of completed written assignments during the jogging phases than during baseline conditions. Two of the three subjects that received the football treatments, however, noted their highest percentage of work completed during the football conditions. Of the three subjects that did not receive the football treatments, two recorded their highest percentage of work completed during the outdoor reading phase. An examination of the relationship between the dependent variables indicates that written assignments completed had a -.42 relationship to talk outs, a -.22 correlation to dean's reports, and a .62 relationship to teacher ratings.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Historically, educators and authors have indicated a relation between appropriate classroom behavior and vigorous exercise. Current writers have suggested that jogging is a particular form of exercise that could improve work habits and emotional functioning. Many of the claims made by proponents of exercise as a mental health technique, however, are based on an accumulation of philosophical writings. Little data have been offered as supportive evidence. If jogging or exercise could be empirically shown to be effective with emotionally handicapped adolescents, practical educational interventions would result.

This chapter presents a summary and interpretation of the study's findings. Limitations of the study are reiterated and practical implications are presented. In addition, recommendations for future research are included.

Discussion

As described in Chapters III and IV, the inter-observer agreement checklists were used to determine whether talk outs were consistently recorded. It is indicated in Appendix C that inter-observer agreement scores were 100 percent for all observations. The observations were, therefore, performed consistently.

Data indicate that all subjects had lower numbers of talk outs and higher teacher ratings during exercise conditions. There were, however, considerable differences across subjects in the extent of the changes. Only two of the subjects had days in which they completed all of their written assignments and had no talk outs. A comparison of the scores obtained during baseline and jogging conditions indicates a higher percentage of completed written tasks and a lower mean number of talk outs for all subjects during the jogging treatments.

Question 1: Is There a Relationship Between a Jogging Program and a Change in the Number and Rate of Talk Outs?

An analysis of the data indicates a lower rate of talk outs for all subjects during exercise conditions. The lowest number of talk outs for the three subjects that participated in winning and losing football occurred, however, during the football treatments. This was illustrated with Subject 1 who had mean talk outs of 6.81 and 2.89 per class session during jogging treatments versus 2.6 and 2.8 mean talk outs during the winning and losing football treatments, respectively.

An analysis of the data from the three subjects that did not participate in football demonstrates significantly lower mean talk outs during the jogging sessions. Subject 6 had the greatest decrease in mean talk outs from 46.9 per class session during baseline to 5.83 during the jogging treatment; a decrease of 41.07 talk outs.

Mean talk outs of 2.5 per class session for Subject 5 occurred during the jogging phase and was the lowest mean number of talk outs during the experiment. Subject 4's mean score of 67.25 was the highest.

When compared to baseline scores, however, all subjects had significantly fewer numbers of talk outs during the jogging treatments. Thus, there appears to be a relationship between decreased number of talk outs and jogging. In addition, perhaps, a stronger relationship is suggested between talk outs and participation in either a winning or losing football game.

An analysis of the mode of teacher ratings shows that, with one exception, all subjects received their highest ratings during exercise conditions. Only one subject during one baseline phase received a mode rating of three.

Dean's reports do not appear to be related to exercise conditions. Only in the data of Subject 4 is a relationship suggested.

An analysis of the correlation coefficients suggests a number of relationships. The .495 correlation of talk outs to dean's reports indicates a moderate degree of correlation as does the -.45 relationship between talk outs to teacher ratings and the -.42 score of talk outs to completed written tasks. These scores indicate one of two possibilities: (1) As talk outs increased, dean's reports increased, while teacher ratings and work completed decreased; or (2) as talk outs decreased, dean's reports decreased, while teacher ratings and work completed increased.

Question 2: Is There a Relationship Between a Jogging Program and a Change in the Number of Completed Written Assignments?

An analysis of the data indicates that for Subjects 1, 2, 3, and 4 a higher percentage of tasks were completed during exercise conditions. Subjects 1, 2, and 3 participated in football. For Subjects 1 and 2 the highest percentage of work completed occurred during the jogging phase. Subject 1 completed 88.6 percent and Subject 2 completed 75 percent of his work while the jogging treatment was in effect. Subject 3 recorded his highest scores of 65 percent of tasks completed during the football phases. An analysis of the data indicates however, that Subject 3 completed a significantly higher percentage of tasks during the jogging phases than during either baseline or outdoor reading conditions.

Subjects 4, 5, and 6 did not receive the football conditions. Subject 4 completed a significantly higher percentage of tasks during the jogging treatments. Subject 5 recorded scores of 47.5 percent and 50 percent of tasks completed during the jogging conditions. These scores are significantly higher than the baseline scores of 25 percent and 33 percent. However, another baseline score of 50 percent occurred along with a high score of 60 percent of tasks completed during the outdoor reading condition. A similar pattern emerged with Subject 6 in that the 52 percent and 60 percent task completion scores obtained during the jogging treatments were significantly higher than the 10 percent and 40 percent scores obtained during baseline conditions. There was, however, a baseline score of 60 percent task completion and a 65 percent score for the outdoor reading phase.

An examination of the correlation coefficients suggests that a moderate relationship is indicated by the .62 correlation between teacher ratings and completed written assignments. This suggests that teacher ratings correspond to the amount of written work done.

Conclusions

There appears to be a relationship between a jogging program and a change in the number and rate of talk outs. The rate and mean number of talk outs were lower for all subjects during the jogging treatment when compared to those scores obtained during baseline conditions. A caution is noted in this conclusion in that the data suggest that other forms of exercise were also related to reduced numbers of talk outs. This effect was noted across all subjects. Talk outs for some subjects were lower during the football condition, for others during the jogging sessions. These data demonstrate that, for the subjects in this investigation, vigorous exercise, as well as jogging, was an important factor affecting behavior. If this finding can be reproduced in other settings with different subjects, a potentially valuable tool for treating behavioral disorders will become available.

The data also suggest a relationship between jogging and football treatments and improved teacher ratings. This relationship must, however, be viewed as non-causal because of the relationship between completed tasks and teacher ratings. With only one exception, a mode rating of 3, the highest rating, was given in all football and jogging conditions. This is compared to the fact that only one mode score of 3 was noted for a baseline condition. These ratings are not a direct measure of behavior, but they do suggest that teachers may view students more positively during an exercise treatment.

There appeared to be little effect of jogging on the number of dean's reports that a student received during the day. Many other variables could have affected this result. Judging from this measure, however, jogging did not seem to have a long term affect on the school behavior of the subject.

Outdoor reading had little effect on any of the dependent measures other than completed written assignments. This suggests that more appropriate educational strategies exist for reducing talk outs.

The data suggest that a relation exists between jogging and a change in the number of completed written assignments. There is also, however, a relation between football treatments and a change in the number of completed assignments. Increased numbers of completed tasks were associated with both football and jogging treatments when compared to those scores obtained during baseline conditions.

Only two of the six subjects increased the number of completed assignments during the outdoor reading phase. These results suggest that, for some individuals, an increase in the number of written assignments may be related to jogging.

There was a moderate correlation between the amount of written work completed and the teacher rating. This indicates that perhaps the most important factor in teacher perception in this investigation was completed work. If this is true in a larger number of settings, behavioral interventions in the regular classroom should account for this factor.

To summarize, it appeared that vigorous exercise, be it football or jogging, was related to decreased talk outs, improved teacher ratings, and, to a lesser degree, to completed written work. This suggests that some emotionally handicapped adolescents may profit from including some form of vigorous exercise in the daily curriculum. Decreasing an inappropriate behavior such as talk outs and improving teacher perception may prove to be extremely valuable in helping an emotionally handicapped youth.

Alternative Explanations

Bailey and Bostow (1979) state that the issues of stability of data, replicability of procedure and effect, and sequence effects must be evaluated in all single case experimental designs. By controlling these factors in any investigation, many alternative explanations for the treatment effect can be eliminated. In the current study, numerous factors which could have affected conclusions drawn from the data have been eliminated.

An examination of the data and obtained Kappa coefficients suggest an acceptable level of stability in all experimental phases. By achieving stability of data over a period of time, temporary changes in the dependent measures and cyclic variability are eliminated. Any confounding effects due to extraneous variables such as adventitious reinforcement, school and home problems, weather, and numerous other factors are lessened because of the stability of the data over an extended period of time.

The observers and teacher were unaware of when the subjects were in a treatment condition. As a result, the possible effects of teacher and observer bias were considerably diminished.

An analysis of observer agreement scores, presented in Appendix C, indicates a high degree of consistency in the measurement of talk outs. These data, therefore, present a believable assessment of the behavior of the subject.

Providing an array of treatments allows a more complete examination of the effect of physical activity and jogging in the dependent measures. An examination of the experimental design in this investigation reveals that each subject was exposed to jogging on two occasions. Outdoor reading, winning football, and losing football were each presented to all subjects on one occasion. The jogging condition was replicated within and across subjects. Non-classroom sedentary activity, alternative forms of exercise, and participating in a winning and losing effort were investigated across subjects. As a result, many alternative explanations for the treatment effects can be assessed and eliminated.

Replicating treatments across and within subjects, as well as interspersing baseline conditions, lessens the possible effects due to the sequencing of experimental conditions (Hersen & Barlow, 1976). As a result, adequate replication of the independent variable is provided, sequencing effects are lessened, and many alternative explanations are eliminated.

The noted experimental safeguards eliminated factors that could have compromised the results. Accounting for elements such as the stability of data, replicability, and sequence effects eliminates many alternative explanations and strengthens the conclusions that can be drawn from this investigation.

Limitations of the Study

The subjects investigated may not be representative of all emotionally handicapped students. Identification procedures vary between school districts. As a result, different types of problems may be identified in other locales. The subjects in this investigation also possessed unique conditioning histories. The experiences and lifestyles of these students cause them to react to situations in an individualized manner. It is, therefore, inappropriate to apply these results to all emotionally handicapped adolescents.

The measurement of talk outs during this investigation was accomplished with human observers. While a high degree of agreement was noted, accuracy can not be assured. The use of a mechanical recording device would have allowed for more precise measurement.

Variables outside of the experimenter's control may have affected the results of the study. Extensive plans were implemented in order to minimize the influence of any possible extraneous variables. In a study of this length, however, influences outside of the classroom can always adversely affect the subjects. Home problems and the social dynamics of a large middle school are two factors that were beyond complete experimental control.

Methodological Limitations

Perhaps the most difficult limitation was the inadequate literature base. Few guidelines for the study could be developed because of the lack of professional literature. As a result, experimental procedures had to be developed with little direction from journals and books.

The problem of stability of data was a major concern throughout the experiment. Few accepted criteria have been developed that adequately assess the presence of steady state responding. The use of Kappa in this investigation was adequate when large numbers were used. When smaller numbers were used, however, it was quite easy to approach the critical value of 1.6. One example in which 1.6 was approached occurred with the values of 1, 2, 1, 2, 1 which yielded a value of 1.5157. If a lower critical value of Kappa had been selected, these data, while showing little variability, may have been unacceptable.

A further difficulty encountered was due to the length of the investigation. It is important in single case design to control for any variables that might adversely affect the results. In conducting a 70 day investigation in a public middle school, numerous variables are presented which affect the subjects and the experimenter. Problems at home, schedule changes, behavior problems outside of the experimental setting, and illness are examples of factors which may effect the individuals participating or conducting the study. Any conclusions drawn from this study must be judged in light of these considerations.

Implications and Recommendations for Future Research

This study investigated the effects of jogging and vigorous exercise on classroom behavior and number of completed written assignments. Teacher ratings and the number of dean's reports per day were also examined. The research followed a single case design and used six emotionally handicapped students from a resource room setting. Recommendations for future research in this area are as follows:

1. Various subjects may react differently to vigorous exercise. Future investigations should seek to examine the effect of exercise on a broad range of subjects and response classes.

2. The effect of exercise on different age groups is a needed area of research. By extending this research to various age groups, generality would be enhanced.

3. Further study might indicate what form of exercise is most effective in changing behavior. Examination of exercise on a continuum from mild to vigorous would begin to add knowledge in this area.

4. The role of body physiology in exercise as it relates to collateral behavior is a needed area of research. Biochemical, kinesthetic, and neurological factors may play an important role in exercise. Determining the extent of such a role would greatly aid those developing interventions for the emotionally disturbed.

5. Mechanical devices for the recording of behavior need to be used in future investigations.

6. Different procedures for implementing physical activity into programs for the emotionally handicapped should be a focus for research. Research in this area would significantly facilitate program development.

Summary

The belief in a relationship between exercise and improved behavior has been noted for thousands of years. Social and educational practices have been predicated on this belief. Much of the support for this association, however, has been philosophical in nature.

The current study provided an empirical analysis of the effects of vigorous activity. For the emotionally handicapped subjects participating in this investigation, there is a relationship between physical activity and improved classroom behavior.

If future research supports these results, physical activity would be a valuable therapeutic tool. Programming vigorous exercise into the educational plan of an emotionally handicapped student may be an effective means of treating certain behavior disorders. Adding exercise to a treatment plan represents a technique that may greatly aid the practitioner in alleviating the behavior problems of emotionally handicapped youth.

APPENDIX A

DESCRIPTION OF SUBJECTS

Descriptor	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Subject 6
Age	13-3	13-11	13-5	13-6	12-9	13-9
Birthdate	11/26/67	3/27/67	9/12/67	8/11/67	5/25/68	5/3/67
Race	White	White	White	Black	White	White
Grade	7	8	8	7	6	7
Height	62"	70"	68"	58"	68"	69"
Weight	107	137	127	97	158	130
Metropolitan Achievement Test (MAT) Grade Levels: (1980)						
Math	6.4	7.4	5.4	3.9	4.9	5.7
Reading	7.2	9.6	10.2	2.8	2.6	2.7
Language Arts	7.4	9.8	9.6	2.5	2.8	2.4
Years-Months in EH Program	6-5	5-1	2-1	6-0	6-5	0-9
Date Placed	9/74	1/76	1/79	2/75	9/74	5/80
I.Q. Score	102	110	109	87	75	89

APPENDIX B

RAW DATA FOR ALL SUBJECTS

Subject 1

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
1	11	1	2	1	
2	16	2	1	0	
3	4	2	1	0	
4	23	1	2	1	
5	19	2	2	2	
6	16	0	2	2	
7	20	0	2	1	
8	23	2	1	1	
9	23	1	1	0	
10	25	2	1	1	
11	30	1	1	1	
12	27	1	2	1	
13	23	1	2	2	
14	28	1	2	0	
15	24	1	1	0	
16	25	0	1	1	
17	35	0	3	0	1.25
18	4	4	2	0	1.00
19	4	3	3	0	1.00
20	5	4	2	1	1.25
21	4	3	2	0	1.25
22	4	4	3	0	1.25
23	4	4	3	0	1.50
24	3	3	3	0	1.25
25	4	4	2	0	1.25
26	4	4	3	1	1.50
27	4	3	3	0	1.25
28	23	3	2	0	
29	26	1	2	0	
30	27	3	2	0	
31	26	2	1	1	
32	27	1	2	0	
33	24	2	3	2	
34	27	2	3	0	
35	24	2	3	0	

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
36	1	4	2	0	1.50
37	16	3	3	0	1.50
38	2	3	3	0	1.25
39	2	4	3	1	1.50
40	1	1	2	0	1.50
41	0	3	1	0	1.25
42	2	3	3	0	1.50
43	1	4	2	1	1.50
44	1	3	3	1	1.40
45	30	1	1	4	
46	22	2	2	3	
47	27	2	2	1	
48	27	2	2	3	
49	25	1	3	3	
50	29	1	2	2	
51	26	2	3	0	
52	24	1	1	0	
53	27	2	2	1	
54	28	2	1	3	
55	2	4	3	2	
56	3	3	2	3	
57	3	3	3	3	
58	2	3	3	2	
59	3	3	2	1	
60	20	0	2	3	
61	21	0	1	2	
62	19	1	1	3	
63	20	2	3	4	
64	20	1	2	0	
65	3	3	2	2	
66	3	2	3	0	
67	2	2	3	0	
68	3	2	3	1	
69	3	3	2	0	

		Subject 2			
Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
1	15	0	1	2	
2	26	1	2	2	
3	33	1	1	1	
4	13	2	2	1	
5	28	1	2	2	
6	24	1	1	0	
7	24	1	1	1	
8	24	0	1	1	
9	23	2	2	2	
10	28	1	3	2	
11	27	1	2	1	
12	31	1	2	1	
13	25	0	1	2	
14	25	1	3	1	
15	26	1	2	2	
16	24	1	1	1	
17	25	2	2	2	
18	26	1	1	1	
19	24	3	3	2	
20	25	2	2	3	
21	25	1	1	2	
22	27	2	1	1	
23	10	3	2	2	1.50
24	6	4	3	3	1.50
25	5	4	3	1	1.50
26	6	3	3	2	1.50
27	6	4	3	2	1.25
28	7	0	1	3	1.50
29	6	3	3	3	1.50
30	6	2	2	1	1.25
31	5	3	3	2	1.50
32	6	4	3	1	1.75
33	20	0	1	3	
34	22	3	2	1	
35	21	2	2	0	
36	19	0	2	1	
37	23	1	1	3	
38	19	0	2	1	
39	37	2	3	2	1.50
40	6	3	2	1	1.50

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
41	3	1	2	0	1.75
42	5	2	3	1	1.50
43	5	2	3	2	1.50
44	4	3	3	2	1.50
45	20	1	3	0	
46	19	1	3	0	
47	23	0	1	1	
48	23	1	2	3	
49	20	2	2	4	
50	20	0	1	2	
51	20	0	1	3	
52	16	1	1	2	
53	21	1	2	3	
54	19	1	2	2	
55	6	2	3	4	
56	6	3	3	1	
57	6	3	3	2	
58	5	2	3	1	
59	5	3	3	0	
60	20	3	3	4	
61	30	2	1	3	
62	21	1	2	4	
63	21	1	2	0	
64	20	1	1	0	
65	4	3	3	1	
66	5	2	3	2	
67	6	3	2	2	
68	5	2	3	1	
69	5	1	2	0	

Subject 3

Day	Talk Outs	Completed Tasks	Teacher Ratings	Dean's Reports	Distance Run (Miles)
1	11	2	2	2	
2	7	2	2	1	
3	8	1	1	2	
4	15	1	1	1	
5	11	1	1	0	
6	13	0	1	0	
7	7	3	2	0	
8	10	0	1	0	
9	12	0	1	0	
10	15	1	1	0	
11	14	1	1	1	
12	16	1	2	3	
13	13	0	1	1	
14	15	1	1	1	
15	14	1	2	1	
16	16	1	1	2	
17	15	2	2	0	1.00
18	8	2	1	0	1.25
19	6	1	3	1	1.00
20	6	3	3	0	1.25
21	7	2	3	1	1.00
22	6	3	3	0	1.25
23	6	3	3	0	1.50
24	6	3	2	1	1.25
25	5	2	3	0	1.25
26	4	0	1	0	
27	16	1	1	0	
28	14	1	1	0	
29	15	3	2	0	
30	14	3	1	1	
31	15	0	1	2	
32	17	1	2	0	
33	17	2	2	1	
34	15	1	1	0	
35	17	2	2	0	
36	14	2	1	0	
37	14	1	3	0	
38	6	3	3	0	1.00
39	6	3	3	0	1.00
40	7	0	1	1	1.25

Day	Talk Outs	Completed Tasks	Teacher Ratings	Dean's Reports	Distance Run (miles)
41	8	2	3	0	1.00
42	6	3	3	1	1.00
43	6	3	3	0	1.25
44	5	1	2	0	1.00
45	15	2	1	4	
46	17	2	2	3	
47	18	0	2	0	
48	14	1	1	0	
49	15	3	3	2	
50	18	0	3	3	
51	15	1	2	1	
52	16	1	1	2	
53	16	2	2	1	
54	15	1	2	1	
55	4	3	2	2	
56	5	3	2	0	
57	5	3	2	0	
58	4	2	3	1	
59	4	2	3	0	
60	20	3	1	0	
61	17	3	2	0	
62	20	0	2	1	
63	20	1	3	0	
64	19	0	2	2	
65	4	3	3	2	
66	5	2	2	0	
67	5	2	2	1	
68	4	3	3	0	
69	6	3	3	0	

Subject 4

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
1	80	2	1	2	
2	70	2	2	2	
3	43	1	2	3	
4	90	1	1	2	
5	60	2	2	4	
6	80	1	3	2	
7	70	1	3	1	
8	14	2	3	1	
9	70	1	1	3	
10	75	0	1	2	
11	73	0	1	1	
12	69	1	2	1	
13	70	1	2	2	
14	71	1	1	3	
15	70	2	3	2	
16	72	1	2	1	
17	61	2	3	0	1.75
18	42	3	3	3	1.50
19	45	3	3	1	1.50
20	40	2	3	0	1.75
21	40	3	2	0	1.75
22	41	2	2	1	1.50
23	39	3	3	4	1.50
24	40	0	1	1	1.50
25	42	2	3	3	1.75
26	42	3	3	3	1.50
27	55	0	1	1	
28	20	1	2	3	
29	75	2	2	4	
30	73	0	1	4	
31	75	1	2	0	
32	72	3	2	1	
33	70	1	2	2	
34	75	2	2	2	
35	75	2	2	2	
36	85	3	1	2	1.75
37	27	3	3	1	1.50
38	6	3	2	2	1.75
39	8	1	3	1	1.75
40	5	1	3	0	1.75

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
41	6	2	3	0	1.75
42	4	3	2	1	1.75
43	7	2	3	2	1.75
44	7	3	2	1	1.50
45	51	3	2	3	
46	50	3	2	4	
47	49	1	2	3	
48	49	1	3	2	
49	51	1	1	2	
50	46	2	2	0	
51	46	1	3	1	
52	44	2	1	2	
53	46	1	2	3	
54	45	1	3	2	

Subject 5

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
1	2	2	3	3	
2	4	2	3	4	
3	4	2	2	3	
4	4	1	3	3	
5	7	0	1	1	
6	5	1	2	1	
7	2	0	1	2	
8		ABSENT			
9	4	1	1	1	
10	6	1	2	1	
11	6	0	1	4	
12	7	1	3	3	
13	5	2	3	0	
14	6	1	2	1	
15	4	1	1	2	
16	6	0	1	1	
17	7	0	1	0	
18	8	0	2	0	
19	5	1	3	1	
20	5	2	2	0	
21	5	2	2	1	
22	6	1	2	1	
23	20	2	3	0	1.00
24	4	3	3	1	1.00
25	2	3	3	2	1.00
26	1	3	3	2	.75
27	1	2	3	0	1.00
28	1	2	3	0	1.00
29	0	3	2	0	1.25
30	2	1	2	1	1.00
31	2	0	1	0	1.00
32	1	0	2	1	1.00
33	13	0	1	0	
34	13	2	2	1	
35	14	3	2	0	
36	15	0	1	0	
37	13	1	2	0	
38	12	2	3	0	
39	6	3	3	0	1.00
40	1	0	1	0	1.25

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
41	2	1	3	1	1.00
42	2	3	3	0	1.00
43	2	2	3	0	1.00
44	2	3	3	0	1.00
45	14	2	2	2	
46	15	1	3	1	
47	15	3	1	0	
48	14	3	2	0	
49	15	1	2	1	
50	15	2	2	1	
51	15	3	2	2	
52	15	3	3	2	
53	14	2	3	1	
54	15	2	2	0	

Subject 6

Day	Talk Outs	Completed Tasks	Teacher Ratings	Dean's Reports	Distance Run (miles)
1	38	0	1	2	
2	36	0	1	2	
3	40	0	1	1	
4	42	0	1	0	
5	60	0	2	0	
6	70	0	1	0	
7	70	1	1	0	
8	13	2	3	0	
9	60	0	2	1	
10	47	1	2	2	
11	47	0	2	4	
12	45	0	1	0	
13	44	1	1	1	
14	40	1	1	2	
15	45	0	2	1	
16	48	0	1	0	
17	50	0	2	2	
18	49	0	1	1	
19	51	0	2	1	
20	47	1	2	2	
21	45	2	3	1	
22	46	0	2	3	
23	2	3	3	3	1.50
24	3	3	3	0	1.75
25	3	0	2	3	1.50
26	2	0	2	1	1.25
27	41	1	1	2	1.50
28	3	2	2	4	1.50
29	3	3	3	0	1.50
30	3	3	3	1	1.50
31	3	3	3	1	1.50
32	2	3	2	0	1.50
33	3	2	2	0	1.50
34	2	2	3	0	1.25
35	35	2	2	2	
36	37	3	2	3	
37	31	2	1	1	
38	37	2	2	2	
39	36	3	1	3	
40	4	2	3	0	1.50

Day	Talk Outs	Completed Tasks	Teacher Rating	Dean's Reports	Distance Run (miles)
41	3	1	3	0	1.50
42	3	3	3	1	1.50
43	4	3	2	2	1.50
44	4	3	2	3	1.50
45	30	2	2	2	
46	31	3	2	3	
47	33	2	2	3	
48	28	1	3	2	
49	31	1	2	1	
50	31	2	3	3	
51	31	2	2	2	
52	29	1	2	2	
53	29	2	1	3	
54	31	2	1	2	

APPENDIX C

INTER-OBSERVER AGREEMENT SCORES

Subject 3   Day 6

Time	5	10	15	20	25	30	35	40	45	50	
Observer 1	1	4	0	0	0	6	2	0	0	0	Total Average Agreement
Observer 2	1	4	0	0	0	6	2	0	0	0	
Agreement	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Subject 1   Day 18

Time	5	10	15	20	25	30	35	40	45	50	
Observer 1	2	0	0	1	0	0	0	1	0	0	Total Average Agreement
Observer 2	2	0	0	1	0	0	0	1	0	0	
Agreement	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Subject 4   Day 38

Time	5	10	15	20	25	30	35	40	45	50	
Observer 1	4	0	0	0	1	0	1	0	0	0	Total Average Agreement
Observer 2	4	0	0	0	1	0	1	0	0	0	
Agreement	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

APPENDIX D

FREQUENCY MULTIPLIERS OF TALK OUTS FOR ALL EXPERIMENTAL PHASES

Experimental Phases	A | B	B | A	A | B	B | A	A | C	C | D	D | A	A | E
Subject 1	÷9.68	x8.55	÷23.04	x21.73	x1.04	÷10.0	x7.6	÷6.91
Subject 2	÷5	x4	÷4.35	x4.57	÷1.05	÷4	x4.5	÷3.75
Subject 3	÷3	x3.8	2.71	x2.29	÷1.06	÷3.75	x5	÷4.08
Subject 4	÷1.25	x2.13	÷24.3	x14.3	÷1.11			
Subject 5	÷4	x10.4	÷10.4	x11.6	x1.0			
Subject 6	÷20.8	x14.6	÷9.7	x8.33	x1.0			

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BIOGRAPHICAL SKETCH

William H. Evans was born July 27, 1948, in Orland, Indiana. He graduated from Adrian College in Adrian, Michigan, in 1970 with a Bachelor of Arts degree in sociology. After graduation, he taught social studies and secondary juvenile offenders at Scotch Plains High School, Scotch Plains, New Jersey.

In 1974, William received his Master of Education degree in special education from the University of Florida. His main emphasis was the education of the emotionally handicapped. From 1974 to June of 1981 he was employed by the Alachua County School System as a teacher of the emotionally handicapped.

William attended the University of Florida from 1977 to June of 1981 as a doctoral student in special education. His major emphasis was behavior disorders with minors in applied behavior analysis and research.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Rex E. Schmid, Chairman
Associate Professor of Special
Education

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Robert F. Algozzine
Associate Professor of Special
Education

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Henry S. Pennypacker
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Cary L. Reichard
Associate Professor of Special
Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William R. Reid

William R. Reid
Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Special Education in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June, 1981

Dean, Graduate School